THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE MINERS' DECISION.

THE Conference of the Miners' Federation is over, and though it did not actually decide to take a ballot vote for a national strike, there can now be but little doubt that the evil day is only postponed for a while. This, however, is something to be thankful for, as it allows time for saner thoughts to prevail, and the miners' leaders have now an excellent opportunity of proving themselves to be leaders worthy of the name, by taking up a strong attitude against the recalcitrant section of their members who are in a state of mutiny quite as much against their recognised chiefs as against the coal-owners and society. Mr. Fenwick, M.P., of the Northumberland Miners' Association—all honour to him—in a well-timed and well-chosen speech, warned the members that the speech of Lord Furness was neither a boast nor a threat, but a bare statement of actual fact, and asked them to give it their serious and careful consideration, before entering upon a campaign which could only end in defeat, and which would involve themselves and others in useless suffering.

The words of Mr. Fenwick, however, appear to have fallen on barren ground, because on the Conference assembling on Thursday last week, it decided to support Northumberland to the extent of a national stoppage to obtain *(a)* a minimum wage of 30 per cent. above the 1879 basis; *(b)* the abolition of the three-shift system; and *(c)* the restoration of all short shifts which existed previously to the introduction of the Eight Hours Act operating in Northumberland.

As mentioned in our article last week, the Northumberland miners have already taken a ballot vote, and succeeded in getting a majority to strike for the second clause, but nothing was stated on the ballot papers regarding the minimum wage, and this has only been tacked on to the three-shift trouble so as to make it a wages question, in order to meet the Federation rule, which we believe we are correct in stating is to the effect that a national strike can only be commanded on a question of wages. Mr. Straker, in making the application on behalf of the Northumberland miners, referred to the Broomhill Collieries, and stated that they were situated quite as well as other collieries in the country to work a two-shift system. Against this, however, we have the statement of Lord Furness that the manager, Prof. Merivale, in a well considered report to the directors, said the increased cost of working the collieries on a two-shift system under the operation of the Eight Hours Act would be between £30,000 and £40,000 per annum; and surely we may take it that these gentlemen know what they are talking about.

On the question of "abnormal places," the Conference decided that each district should arrange meetings between the coal-owners and miners' unions, to try to come to some local agreement, and, failing this, the Conference will meet again on November 14th to decide whether a national strike shall be balloted for or not. We sincerely trust that the negotia-

tions locally may be successful in deciding this difficult problem, but considering the rebellious nature of the younger and more headstrong members of the unions, we confess we have little faith that it will bring any lasting peace. The minimum wage for all workmen would only be demanded with increased insistence; the action of the Northumberland men is also to be reckoned with, and we have little hope, judging from the speech of Mr. Straker, that they will see the folly of striking.

Considering everything, therefore, we are reluctantly compelled to admit that a national coal strike may be upon us possibly before the year is out; and it would be as well for all electrical undertakings to watch their coal supplies, but all the time to be prepared, as it is only by adequate preparation that one section of society can ward off tyrannous and unreasonable attacks from another. The success or defeat of the strike will largely depend upon such preparation, and finally, we would point out that to defeat the object of the miners would not only make for the benefit of the nation, but would be of lasting benefit to the coal trade and to the miners themselves.

The Demand for Technical Men.

A letter in the *Daily Mail* of September 26th, emanating from the Falcon Works, Loughborough, drew attention to the "difficulty in obtaining the services of young men properly trained in the erection and installation of electrical machinery and carrying out of contracts." So serious was this difficulty that the writer suggested that if recruiting for electrical service were not stimulated, British firms would have to import such men from the Continent.

This letter drew a joint reply from two correspondents in Taunton, who declared that the profession of electrical engineering was already overcrowded with qualified men, either earning a miserable wage or else unable to obtain a position in any capacity, and to enforce their argument they referred to our advertisement columns, which, they said, contained many advertisements for premium pupils, to pay considerable sums for the privilege of working for the advertisers, but only a few for trained men, and those at salaries from 10s. to 30s. a week. In their view, it was inadvisable for anyone to enter the profession, unless he had a private income! A third letter showed how the writer had placed two of his sons in medicine and the Church respectively, with immediately successful results, whereas two other sons who had been well trained in engineering, including electrical engineering, found it difficult to obtain employment at a salary above £150 a year.

What, then, are the actual facts? Excluding exceptional cases, is the profession of electrical engineering still overcrowded, as it certainly was a few years ago, or is it not? Too much importance must not be attached to the views expressed in the letters abstracted above; on the one hand we have a firm which takes a number of premium apprentices, and may find it less easy, for various reasons, to obtain them than formerly (be it noted that if an adequate supply of college-trained premium pupils is forthcoming, there will be no lack of choice among these on the completion of their pupilage to fill the posts referred to); on the other hand, there is a large class of men who have not had the benefit of technical training, and who, finding themselves unable to rise above the position of shift engineer, utter bitter complaints as to the overcrowding of their ranks, which they confound with the overcrowding of the profession. Whether the Taunton letter is of this nature or not we cannot tell; but it savours somewhat of that complexion.

More reliable indications, perhaps, can be obtained from two other sources: the technical colleges and the large firms who do not receive premium pupils. During recent years we have pointed out, in reviewing the annual reports of the City and Guilds of London Institute, that the number of students admitted to the electrical engineering departments of the Institute's Colleges has steadily declined for many years, while the number admitted to the civil and mechanical engineering departments has correspondingly increased. The Colleges in question have not by any means lost prestige during that period, but, on the contrary, have been greatly improved in staff and equipment—the Central Technical College, moreover, having become an integral part of the Imperial College of Science and Technology; the increase in the number of mechanical engineering students also goes to show that the Colleges are as popular as ever. The change, therefore, must be ascribed to the growth of a general public opinion that electrical engineering was overdone; and that view was, no doubt, in accordance with the facts.

But the turnover, which was not confined to the London Colleges, and was of considerable magnitude, was bound to have its effect in time; and, in fact, the time has arrived already. For the past two years, the demand for electrically-trained men from the Colleges has exceeded the supply. Large manufacturing works, which take no premium apprentices at all, apply to them for such men, and are unable to obtain them. At the present moment the City and Guilds (Engineering) College, at which 30 students received the Diploma in Electrical Engineering last summer, has applications for five electrically-trained men, but has none to send.

The pendulum has swung past the point of equilibrium, and the excess demand is almost certain to continue to increase, for there is a time lag between public opinion and actual fact; just as the rush into electrical engineering continued until the profession was congested, so the shortage will probably endure for some years to come. The rapid and continuous development of the applications of electricity, which tends always to increase the demand, acts now in the same sense as the delay in public opinion, and the growing realisation of manufacturers that highly-trained men are essential to their business is a third factor with the same tendency. We believe, therefore, that parents who wish their sons to embark upon a profession of infinite possibilities and fascinating interest—even though it be not highly lucrative—might do worse at this time than place them in electrical engineering.

The Continental Glow Lamp Syndicate.

Various reports have recently been in circulation in Germany to the effect that the Continental Glow Lamp Syndicate, which only controls the trade in carbon-filament lamps of the principal makers in Germany and Austria, is on the point of being dissolved. The Verkaufsstelle Vereinigter Gluhlampenfabriken, which is the title of the syndicate which has headquarters in Berlin, now states that the lamp-makers combined in the syndicate concluded agreements for a period of 10 years, which will only expire on March 31st, 1914. It is added that in the meantime no proposal has been made from any quarter for an earlier dissolution of the combination. As compared with this statement, a Berlin newspaper observes that some of the constituents intend to give notice prematurely, and that the absence of a formal proposal at present does not mean much. On the other hand, a Frankfort newspaper states that the idea has prevailed in electrical circles for some time past that the continuance of the syndicate has become very doubtful, because the sales of 30,000,000 lamps provided for in the present year will scarcely be reached. The idea has some probability, but nothing definite can be said before the end of the season, which is now beginning. Taken as a whole, the business in carbon lamps has decidedly decreased, and, in point of fact, in the same degree as the prices of metallic-filament lamps have been reduced. As will be remembered, this took place in the first instance about two years ago, and since then quotations have further declined in consequence

of the aggravation of competition through large extensions of works on the part of the original makers, and through the addition of new works. Nevertheless, the wire lamp still costs from three to four times the price of the carbon rival. The idea of also syndicating wire lamps has repeatedly been advocated, particularly by the less important makers, whilst the question has likewise been discussed at times by the largest producers. The result has, however, hitherto been of a negative character, owing to the facts that the extension of factories has not been regarded as having been finished, and that an end to technical improvements in the lamps cannot be foreseen. In addition to these considerations, the profits on manufacturing—at least, those of the large firms—do not seem even at present prices to have been converted into a loss that would compel one maker or the other to give way on the question of a syndicate. If, therefore, the carbon-lamp syndicate should really be dissolved by the end of this year and not be reformed under other conditions, a period of free competition may be expected in German trade circles for both types of lamps.

The Burden of Giving a Character.

One of the most troublesome duties which falls to the lot of the employer is the giving of a character. When the conduct of a workman has been satisfactory, to speak well of him is a pleasure; but it is irksome to speak ill of anyone, even in the performance of a duty. Nor is it easy to escape from the task. To refuse a character altogether is, from the worker's point of view, the worst possible course to adopt. It may well be that the reason why a man was dismissed from one service will not militate against his successfully filling another post. Some people endeavour to shirk responsibility either by giving a purely colourless character, or by confining themselves to one or two words of commendation. Thus a man might be truthfully described as a "skilful machinist," although he was unpunctual or lazy. Experience has shown that the only safe course is to reveal the truth, the whole truth, and nothing but the truth. That anything in the nature of *suppressio veri* is fraught with danger to the employer himself is revealed in a case which was heard in the Marylebone County Court last week. The facts were very simple. The plaintiff, a grocer, who advertised for an assistant, received an answer from a man who gave him the defendant's name as a reference. The plaintiff applied to the defendant, who said that the man had been in his employment for three years, and that he was honest and a good worker. Upon this he was employed by the plaintiff. After having been employed for six months, he was convicted of theft. The plaintiff thereupon brought suit for damages against the defendant. From the somewhat meagre report, the judge appears to have been satisfied that the plaintiff asked the defendant whether he knew anything against the assistant; that the defendant replied that he did not, and that, in fact, the defendant knew that another employer had alleged dishonesty against the assistant. In the event the plaintiff had judgment and obtained damages. From this case it would appear that it is the duty of an employer when asked a general question as to honesty to reveal anything he knows, whether derived from his own experience or from information. On the contrary, suppose the question put was: "Has he been honest while in your service"? It is conceived that "Yes" would be a sufficient answer. Nevertheless it is clear that the employer would incur no liability to an action for libel whatever he revealed, because all communications of this kind when made without malice are absolutely privileged.

Electro-Harmonic Society.—The 1911-12 season opens with the concert to be held on Friday next, October 20th. The following are the dates on which concerts will be held:—

Friday, October 20th, 1911.—Smoking concert.
Monday, November 20th, 1911.—Ladies' night.
Friday, December 15th, 1911.—Smoking concert.
Friday, January 12th, 1912.—Smoking concert.
Tuesday, February 27th, 1912.—Ladies' night.
Friday, March 22nd, 1912.—Smoking concert.

All are to take place in the King's Hall, Holborn Restaurant, commencing at 8 p.m.

THE INFLUENCE OF WIRING METHODS ON HEATING AND COOKING.

By J. W. B.

The arguments in favour of systems of charging for electricity supply of the "Telephone," "Norwich" and other "fixed price plus cheap rate" class are many, although it is not difficult to bring forward an equal number in support of the separate-meter system. One of the principal advantages claimed for the "common meter" is that it allows energy for any purpose to be drawn from any part of an installation—a distinct benefit, but one not likely to have so far-reaching an effect on the introduction of electric heating and cooking in ordinary houses as some have imagined, for the following reasons:—

The general use of electricity for cooking, and, later, for heating, cannot be brought about by cheap supply rates alone, but must be assisted by facilities for hiring the necessary apparatus.

Heating stoves and cooking ranges can seldom be used at any point on a lighting system, owing to the wiring being too small for their requirements.

Small consuming devices such as irons, kettles and fans are not likely subjects for hire, although given an attractive system of charging for energy, it can be shown that it would pay to give them away, within limits, if such a course were possible.

It may be stated that the first field for electricity supply, after lighting, lies in cooking equipments for flats and houses of a value up to about £60 per annum in rental. In larger establishments the cooking appliances are usually satisfactory and combined with hot water supply, whilst economy in service is not a first consideration; therefore it appears that the principal revenue-earning apparatus will be used in positions where, on the one hand, separate wiring is essential, and on the other, owing to the energy being all taken at one point—the kitchen—the cost of such separate wiring need not be a serious item, and should be met by the hiring charge together with maintenance and inspection. In such cases the only objection which can be raised to a separate meter lies in the rental involved. As the actual extra cost of this to the supplier will be of the order of 4s. per annum, this also can be charged up in the general hire terms.

Amongst the advantages of the separate rates and meters are:—

The lighting account is not obscured, and can be averaged in case of meter failure; whilst any attempt to feed the lighting off the heating circuit can be more easily detected.

The lighting meter can be kept small—*i.e.*, accurate on light load. A meter which would be large enough for the requirements of a 2 to 3-kw. cooking outfit would in a short time allow 30 to 60 c.p. of light to be obtained free; this point should be borne in mind when framing the fixed charges for single-meter systems, an essential feature of which must be a comparatively high and protective fixed charge with the lowest possible rate per unit, because, owing to the great range of load upon such meters, and the impossibility of gauging their performance by inspection of the accounts, their average accuracy will suffer, and their revenue-earning responsibility should be reduced accordingly. In other words, the tariff must be so framed that the consumer has nothing to gain over the usual flat rate terms by wasting light, and so raising the peak unnecessarily, whilst the low rate per unit tempts him to employ electricity for every possible purpose, with resulting increase in diversity and load factor on the supply system.

These considerations with regard to separate wiring are of increasing importance in view of the efficiency of the metallic lamp, and the increased conductor loading permitted by the I.E.E. Rules. At the present time, installations of 30 to 50 lights are being carried out entirely with 3/22 or 1/18 wire, and on A.C. systems the use of voltage reducers still further complicates the question of using energy for other purposes than light. However, the low-voltage metal lamp has done so much to secure the position of electric lighting in the public mind that these drawbacks should

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not be overrated, but the remedy should be looked for rather in cheap and simple systems of "heat" wiring, which may run from room to room, and either be metered separately or connected to the light wiring at the source of supply as desired.

Generally speaking, one heating point per room can be made to serve all requirements, multiple plugs being used if desired. From the service entry to the kitchen ample capacity should be provided, the conductors diminishing as the circuit travels through the house. For this work a loop-in plug socket with fuses "forward" and switch on the branch circuit is desirable.

For the circuit, several surface systems offer themselves. Stannos material, used double, lead-covered V.I.R. twin cable, heavily rubbered twin-wire "cab-tire" class, are all suitable and easily fixed, the latter having the advantage that it may also be easily removed, while its character and appearance is in itself a protection, it being difficult to mistake it for a non-electrical pipe, as may happen with the metal-covered conductors.

In running circuits of this class, it may often be found convenient and possible to run lead-covered wiring along the outside of the building, looping in and out of each room through the woodwork of the window frames.

In such cases the lead sheath should be made continuous and earthed and fixed only with lead cleats. Stannos material has been used extensively in a similar way, and although such circuits may be damaged by the operations of the builder or gardener, faults are easily found and remedied and internal disturbance is reduced to a minimum.

SUPPLY STATIONS AND ELECTRICAL CONTRACTORS.

[COMMUNICATED.]

Of recent years there has been much dispute as to the authority and justification for central stations carrying out wiring (and in some cases, supplying fittings), thus taking unto themselves the duties and profits usually the monopoly of electrical contractors. It is naturally difficult to secure disinterested views on this contentious matter.

One of the commonest arguments against such action by central stations is the statement that the latter thus attack private trading by the use of ratepayers' capital (where a company-owned station is concerned, the argument is, of course, inapplicable). It is often forgotten, however, that the station *provides* the contractors' field by the same means! The electrical contractor depends primarily upon the central station for his living, but the station is not necessarily dependent upon the contractor, who is therefore ill-advised to assume any unreasonable or domineering attitude. On the other hand, electrical contractors have done, and are doing, much excellent work, and are quite entitled to a fair living, providing they duly consider the position and needs of the supply station. Mutual co-operation between station and contractor is the best policy for both, providing each is willing to accept "rough" cases with the "smooth," to the ultimate joint benefit of the allies.

Going further, manufacturers should study the needs of central stations and contractors to a closer extent than is at present common, and contractors and stations alike should "push" the adoption of the best goods available (at a commensurable initial cost), and should study the consumer by selecting apparatus most economical in overall operating cost. By such co-operation and temporary sacrifice by individual parties, the utilisation of electric supply will reach such an extent, and at such a rate, as would otherwise be unattainable.

Station engineers frequently seek authority to assume the functions of electrical contractors (when such assumption is barred by their original statutory powers), on a plea of *(a)* the heavy losses of the central station due to the introduction of metallic-filament lamps, or *(b)* the contractor's laxity in seeking new business or attending to that already secured.

It is quite fair to argue that the contractor should not be expected to bear the burden of the metallic-filament lamp crisis, yet there is no reason why the vigorous publicity and canvassing campaigns, now adopted by most stations, should not return something more than a bare extension of supply to the latter. The whole cost of such aggression, as well as of all specially favourable tariffs granted to certain consumers, falls upon the central station, which, therefore, seems quite entitled to at least a proportion of the profit on equipment installed as the result of its efforts to extend the demand for current. Many stations supply wiring and fittings at a very low profit with the avowed intention of merely securing maximum satisfaction for their consumers. This policy is to some extent laudable, and certainly secures the station from any reproach of direct interest in the contracting work, but it obviously causes more injury to contractors than would be inflicted if the station demanded a fair trading profit.

For the lethargy of contractors in supporting the central station, there can be not the slightest excuse. Lack of energy on the part of the contractor is as adverse to the interests of the station as to his own profits, but an even worse evil is to be found in work badly designed or executed or performed at unreasonable rates. In such instances, quite a wide loss of business may be incurred by restricted developments on the premises of the victim, and of those of most of his acquaintances. In any such case, the supply station is fully justified in taking over as much of the contracting work as it deems necessary in its own interests.

As regards publicity and canvassing, contractors and supply stations should certainly work hand in hand. Half-hearted efforts in this direction are worse than useless. Advertisements booming the use of electricity should appeal to as wide a range of prospective customers as possible; they should deal with the latest methods and apparatus for every application, and should degenerate to no set form. The impression should be created that the whole electrical industry is intensely "live" and prepared to cater for each and every requirement. The despatch of publicity matter to, and canvassing of, *individuals* must take very careful account of the probable temperament of the latter; no such aggressive and ferocious style of approach, as is favoured in the States, would be tolerated by the average British householder.

Central stations as a whole, have still to override the general impression that they enjoy an autocratic, rapacious monopoly, and in closer co-operation between contractors and central stations, in seeking and supplying fresh consumers, may be sought the most favourable means of securing maximum profit to both and maximum satisfaction to consumers—the latter state invariably leading to further developments.

EVENING CLASS REFORM.

By P. GOOD.

Evening classes in technical schools often include classes for electrical engineering and electricity and magnetism, in which instruction is given at very low fees.

There are two examining bodies, the Board of Education and the City and Guilds of London Technological Department. Broadly, the Board of Education deals with magnetism and electricity as a science, and the City Guilds treats it as a trade.

If the fundamental object of these classes is the production of an intelligent electrician as distinct from a good mechanic, it is necessary that the elementary training be not too difficult, but it must be very accurate and on sound lines.

The students entering these classes vary very much in age and early training. As a rule few know anything of the use of squared paper or the usual meaning of π. More than half may know nothing of simple proportion, and be unable to do the most elementary algebra. Many will have no idea that there is such a thing as air pressure or quantity of heat, and the sine, cosine or tangent of an angle has never before been heard of by them.

With this material, even with 40 classes in the session, the teacher can only get the more advanced through the

elementary examination, and then only by preparing the students with the one object. The other students gain very little from the course, and the attendance probably slowly drops as the session proceeds.

The equipment of the class room sometimes leaves much to be desired. Particularly is this the case where several teachers have followed one another, each with his own ideas of the ideal apparatus for teaching purposes. Sometimes no assistance of a skilled order is available to keep the apparatus in perfect condition. Probably plenty of money has been spent, but it has been laid out in small amounts over a number of years.

In the event of the teacher's absence, either he must find a substitute or the class is not held. In one case the students turned up for several weeks, and found no teacher. When the teacher returned he found no students.

At the commencement of the session the students usually ask for the name of a suitable text-book. If the teacher happens to be the author of an elementary work, however bad, it, of course, becomes the standard work on the subject. If he is not, then either he must find a suitable one or recommend the best available.

The elementary text-books may be divided into two classes: the theoretical and the practical. The first usually contains a lot of information, fairly accurate but unsuitably arranged, and the other is usually so fundamentally inaccurate that it is only suitable for dabblers in the subject. Looseness of expression perhaps better describes its chief fault.

The teaching is usually divided also into theoretical and practical, and usually one hour is devoted to lecture and exercises and two hours to experimental work. In most cases the apparatus must be used for several classes, such as the senior and junior, so that an unfinished experiment must be disconnected and a week afterwards got ready again.

Having thus briefly stated the conditions under which the work is at present being carried on, a few suggestions may be made for the removal of some of the difficulties.

The examining bodies should jointly set one elementary course and examination called "Elementary Electricity." This should include some mathematics, physics and chemistry, and no one not able to pass this should be allowed into the electricity, wireman's senior, electrical engineering, telegraphy or other electrotechnical classes; elementary wiremen's practical classes might be the only exception.

In the case of older students who have not passed the official examination, they should be obliged to satisfy the teacher that they could pass it, and should then have to take it at the same time as the more advanced examination.

This procedure would ensure a reasonable progress in the next class, would bear fruit throughout every student's career, and would raise the status of the whole profession in course of time.

For this year's work and the one to follow, text-books should be prepared to the order of the education authorities by the most competent man available. He could be assisted by less competent men if necessary, but it is essential that a really clever man who has attained eminence in his profession should prepare these very elementary books. There are far too many at present written by the instructors and other quite ordinary men. These books are poison. The other type of book frequently has a good name on it, but was written so many years ago that it is useless.

No doubt the publishers cannot afford to pay the fees necessary for the production of a good book when they have to sell it at 2s. with a limited market, but if the City Guilds and the Board of Education jointly produced one the sales would be such that high fees could be paid without loss. There are several existing good books, but they cost from 5s. to 10s. each, and this is far too much. It is more than the fee charged for instruction for a whole session. The next step would be to prepare a full list of apparatus necessary for a class of 10, 20 and 30 students, and before making any grants they should insist on this equipment as a minimum and permit of no reduction. Other apparatus there might be, but this list should be essential before a grant is allowed.

Each course naturally requires a different equipment, and a small portion of the elementary apparatus could be available, if necessary, for the seniors.

These rules would ensure the satisfactory starting of the classes, and would prevent any local authority starting an Electrical Class tentatively. If students are invited to attend these classes, someone should see that one whole year of their time is not wasted owing to the fault of a parsimonious local authority.

The inspectors should be instructed to report on the condition of the apparatus as well as on the attendance.

At all the smaller institutions the major effort should be with the elementary work only. Then, even at the risk of reducing the average attendance, the men should be advised to go elsewhere if the work of the class is not likely to be beneficial.

Most of this is directly opposed to the somewhat influential class of educationists who advocate the suppression of the examination test and say, "Trust the teacher." This policy may be right if you have a highly skilled, highly paid staff of teachers, but even then it is probable that the early stages of any study require much more rigidity than the later ones, and these criticisms are not meant to refer to the very advanced instruction so ably given at some of the larger schools.

It is not desired to slight in any way the mathematics and general scientific classes usually held and frequently recommended to the students. These are very useful, but they would be more so if they were made compulsory.

PROCEEDINGS OF INSTITUTIONS.

Conference of the Institute of Metals.

The autumn meeting of the Institute of Metals was held in Newcastle-on-Tyne at the end of last month, when the usual crop of papers was presented. It is difficult to understand why this Institute (which we are pleased to note is making such excellent progress both in point of membership and in effective work), or the Papers Committee of the Institute, does not exercise greater care in the editing of the papers presented for reading and discussion at meetings. The subjects, as a rule, are all of them important and interesting, but the chief points are often obscured by a mass of unnecessary verbiage which makes it difficult to follow the authors' arguments. Did space permit, we should reproduce some of the long and involved sentences which we have underlined in two or three of the papers, and which leave the reader in a state of mental confusion. Such sentences are, more often than not, absolutely meaningless when they are intelligible, and the papers would gain considerably in value if they were deleted altogether.

Taking the papers as a whole, it is significant that a considerable portion of them dealt with the causes of corrosion in non-ferrous metals. It appears now to be admitted that corrosion is due to local electrical action, and it has long been known that it is assisted by the presence of moisture. From time to time suggestions have been forthcoming regarding precautions to be adopted in specific cases, but there is obviously a great amount of work yet to be done before the engineer can be freed from the troubles of pitting, erosion and brittleness in tubes, wires or structural parts where brass, copper or bronze is used under adverse circumstances. The paper by Mr. D. R. Pye on the mechanical properties of hard-drawn copper wire reveals the curious fact that, so far as relates to a particular set of observations, the breaking load is proportional, not to area, but to the circumference of the normal section.

Considerable vagueness exists in this country as to the properties of hard-drawn copper wires, and Mr. Pye complained that there was no standard specification to act as guide as to what might be expected in point of tensile strength and elongation before fracture. The Post Office specification of tensile strength of 27 tons per sq. in. is quite normal for wires of 0·2 in. diameter, but a strength of 23 or 24 tons per sq. in. is scarcely ever attained in wires of 0·5 in. diameter. At the present time a number of different specifications are in use, almost every tramway or other system having one peculiar to itself. Mr. Pye suggested that a satisfactory definition of hard-drawn copper should run somewhat as follows: "Hard-drawn copper, when in the form of circular wires, should have a tensile strength not less than that given by the formula $T = 30 - 20\,D$, and an extension per cent. on a marked 10 in. length, including the point of facture, of not less than that given by the formula $e = 5\,D$, where T = tensile strength in tons per square inch of original section, e = extension per cent., and D = diameter of the circular rod in inches.

The Engineering Standards Committee was criticised by Mr. Pye, and in the subsequent discussion, Mr. A. P. Trotter took upon himself the responsibility for the remarks made by Mr. Pye under that head. Mr. Trotter further said that it was clearly necessary that further tests should be carried out; but the whole process of wire drawing was a mystery to outsiders; he complained that manufacturers would not describe their processes, and users had to take

what they could get rather than what they wanted. Sir Gerard Muntz said it was essential in drawing up a specification to take into account differences of diameter.

Dr. Wm. Guertler presented a paper in which he drew attention to the property of electrical conductivity in its bearing upon the practical determination of the constitution of alloys. He indicated the limitations of methods that metallurgists were in the habit of using for the investigation of the constitution of alloys. The relationship between concentration, temperature, and any given property—electrical conductivity, magnetism, &c.—was, he said, best brought out by the employment of the co-ordinate system in these dimensions. Thus, taking concentration as the base, ordinates should be erected from it, having lengths proportional to the numerical values under consideration. Thermal analysis often failed, particularly when a state of complete stable equilibrium was unattainable within a comparatively short interval of time. Dr. W. Rosenhain, in discussing the paper, thought that a good deal of work would still have to be done in the direction indicated by the author, but he did not deprecate the value of electrical methods, and complained that metallurgists had neglected these methods too much in their adherence to thermal analysis and microscopical examination. Dr. C. H. Desch expressed the opinion that Dr. Guertler's method was likely to prove of the greatest value, while Prof. T. Turner was satisfied that the author had drawn attention to the hopelessness of expecting to obtain material of good conductivity from an alloy.

The method of electrical conductivity can be employed, as Dr. Guertler showed, as a means of obtaining the necessary data for the construction of an equilibrium diagram, in a manner analogous to the application of thermal analysis, a matter which was adversely criticised by all who took part in the discussion of Dr. Guertler's paper. But the conductivity method has the great advantage that it is independent of time, and no measurement need be taken until we are assured that perfect equilibrium has been obtained. Granted that we know the equilibrium diagram with certainty, we can, if we have the absolute values, compare the different concentrations with one another and construct isothermals from them, from which in their turn we can find the breaks which correspond to the passage of boundaries of the phase regions, and more particularly of these which run vertically, and which cannot consequently be obtained by other than the electrical method.

Before leaving the subject of the Conference, whose proceedings we have just discussed, reference should be made to an eminently practical paper presented by Mr. George Hughes on the use of non-ferrous metals in railway work. This paper was one of the best that has ever been read before the Institute of Metals; it was clear and free from involved theory and represented results obtained in actual practice. Aluminium, said Mr. Hughes, was slowly supplanting the use of other metals in railway engineering and rolling stock. The outside panels of electric cars built for the Liverpool and Southport line of the Lancashire and Yorkshire Railway to work in conjunction with the Liverpool overhead line are made of No. 16 S.W.G. aluminium, the largest panel at the side of the car being 6 ft. 7½ in. long × 2 ft. 8 in. wide. According to Mr. Hughes, the initial cost of aluminium panels is much greater than for mahogany or steel, but a reduction in the cost of haulage of nearly 33 per cent. as compared with the former, and nearly 60 per cent. as compared with the latter, is obtained. Mr. Hughes remarked that the soldering of aluminium was a difficult problem, but a good deal of use is now being made of the autogenous welding process, and, as Mr. Hughes is probably aware, this is giving satisfactory results.

Electricity in Mines: The Avoidance of Accidents.

At a joint meeting of the Scottish Branch of the National Association of Colliery Managers and the West of Scotland Branch of the Association of Mining Electrical Engineers, the discussion was resumed on the paper recently contributed by Mr. Robert Nelson, H.M. Electrical Inspector of Mines, Home Office, London, on this subject.

Mr. C. A. Atchley, Kilmacolm, said the question of accidents due to electricity in mines was becoming a very serious one. He thought that in the majority of instances, particularly in new work, armoured cables were safer than unarmoured cables, but feared that in introducing armoured cables right away in preference to unarmoured cables, which represented at present the bulk of underground cabling, they were going much too fast. The class of men which was quite able to keep up an unarmoured cable installation was not—except after a considerable period of training—equal to the responsibility of maintaining an armoured cable system. Until they had had an opportunity of training a body of men capable of undertaking the work, the compulsory use of armoured cables in a colliery, particularly with the D.C. system, should be gone about slowly.

Mr. A. B. Muirhead, Lenzie, said he was not satisfied that the earthing of everything was going to result in safety. If everything electrical in the pits was to be connected up through armouring and carefully earthed, the standard of insulation might begin to deteriorate, with the result that, very soon, they would be worse off than before. The question of insulation was not receiving the same amount of attention as earthing.

Mr. McVie, colliery manager, Bothwell Park, Lanarkshire, said that colliery managers were in somewhat of a difficulty, because they had the Home Office issuing rules that every system was to be earthed, while, on the other hand, they had experts like Mr. Muirhead asserting that the Home Office was practically in the wrong. The Home Office was altogether on wrong lines in insisting upon earthing throughout the whole of an electrical system.

Mr. G. L. Kerr, Glasgow, asked whether it was preferable to earth a section of the plant underground locally, or to bring the whole of the earthing to some central point at the surface. Then there was the further point as to whether the earth wire were better carried outside or inside the cable. At least one fatal accident had occurred where the victim actually lost his life on the earth wire.

The Chairman said the point raised by Mr. Kerr as to whether the earth wire should be outside or inside the cable, was one which was giving electrical engineers some concern at the present time. At one period he favoured the idea of the earth wire being inside, but now, in the majority of instances, he was absolutely opposed to that if he could get it on the outside. If an earthing system were adopted they could not have too many earthing points; the surface should be one of these points. With regard to the question whether three-phase or direct current was the more dangerous system, he had no hesitation in pronouncing against three-phase.

At the close of the discussion, Mr. Frank Anslow (Glasgow) said he did not think that it would be possible to maintain such a perfect condition as to render it impossible to obtain a shock by touching either pole; that, given good material, workmanship and supervision throughout, an unarmoured system could be made and maintained as safe as an armoured system. It certainly looked as though an armoured system, when efficiently earthed, would, at the present time, offer the best solution. In very many cases an imperfect earth had been secured, which was considerably more dangerous than no earth at all, as it gave a feeling of false security. Earthing must be carried out well, and he agreed with Mr. Nelson that two earth-plates placed at a suitable distance from one another were far more effective than one earth-plate of double the size.

THE BRITISH ASSOCIATION.—V.

On the Radiation Producing Aurora Borealis.

By L. Vegard.

Section A. (Abstract.)

Starting from the view advocated by Birkeland, that auroræ are caused by electric solar radiations, the author treats the problem of determining their physical properties. He arrives at the conclusion that the law of absorption of the solar rays is essentially the same as that of α-rays. It is found, from the relation between range and velocity, that α-rays will get down to heights varying between 70 and 300 km., which is the interval actually observed for most auroral forms. Further, calculations show that α-rays will strike the atmosphere at an angular distance from the magnetic axis of about 17°, which gives the right position of the auroral zone. The distribution found for a number of polar stations shows two distinct night maxima, and their existence is found to be in accordance with mathematical theory.

The author finds that the α-ray hypothesis, as far as our present knowledge goes, explains in a satisfactory way the properties of the definite auroral forms, while the assumption of a radiation of the β-ray type meets with serious difficulties.

Magnetic Observations at Falmouth Observatory.—Report of the Committee.

Section A. (Abstract.)

The mean values of the magnetic elements for the year 1910 are as follows:—

Declination	... ...	17° 41·6′ W.
Inclination	... ...	66° 29·0′ N.
Horizontal force	...	0·18802 C.G.S.
Vertical force	... ...	0·43208 C.G.S.

The magnetographs at Eskdalemuir have now been arranged to record directly the variations in the northerly, westerly and vertical components of the magnetic force. Regular tabulation of the curves commenced with January 1st, 1911.

Smoke Abatement.

By Dr. J. S. Owens.

Section G. (Abstract.)

The present legal standard of "black smoke in sufficient quantity to be a nuisance" is admittedly unsatisfactory, as black smoke is a thing rarely, if ever, seen; also, the blackness alone is no measure of the amount of pollution nor even of the amount of soot per ton of coal burnt. The present standard is therefore out of date.

A sound standard of maximum allowable amount of smoke should be fixed and enforced. The standard suggested is one of *maximum density for maximum time of emission*. By density is meant amount of soot per unit volume of flue gas. A smoke of great density would be permitted for a short time only, whereas one of less density might be permitted for a longer time.

The method of measuring the density suggested is by matching the opacity of the smoke to that of calibrated smoked glasses, each glass representing a certain density of smoke in a column of unit

thickness. The final figure for comparison is obtained by dividing the density represented by the glass by the diameter of the chimney. By careful construction and the elimination of certain errors, an instrument can thus be made to give a fair basis of comparison with a standard density. The author has devised and experimented with an instrument of this type, with promising results.

Power Generation by Overtype Superheated Steam Engines.

By W. J. Marshall.

Section G. (Abstract.)

The overtype superheated steam engine consists of a special tubular boiler with the engine mounted on the top of it, the boiler forming the foundation or bed-plate for the engine. A superheater is placed in the smoke-box and forms an integral part of the plant, as also do the air pump, condenser, &c., when such are fitted. The result of this arrangement is that steam pipe losses are reduced to a minimum, and the full value of the superheated steam can be employed. The cylinders can also be jacketed with high-pressure steam from the boiler without any loss due to drains or steam traps, as the cylinder casing forms a portion of the steam space of the boiler. The boiler and the superheater are carefully designed as regards their heating surfaces to give the highest efficiency. Particulars of exhaustive trials on one of these engines were given, showing that 1 B.H.P. can be obtained with a consumption of 1·21 lb. of steam coal per hour. A detailed description of the "Garrett" engine giving full particulars of its construction was also given, with drawings and photographs showing actual installations of some of these engines.

A Friction Permeameter.

By W. H. F. Murdoch, B.Sc., M.I.E.E.

Section A. (Abstract.)

This instrument is a development of those described in a paper by the author, viz., "Magnetic Testing of Iron."

The object of the arrangement is as follows: To keep the magnetic circuit invariable during a test; to keep the coefficient of friction constant; to have unidirectional sliding of the moving portion and no necessity to reset the specimen at each reading; to arrange matters so that the magnetic induction over the gap is as uniform as possible, so that the law of traction is fulfilled; to eliminate errors in H, the resistance of the magnetic circuit should be reduced to a minimum; the instrument also should be direct reading and portable.

The instrument consists of a specimen of cylindrical section, magnetised by a solenoid excited by an electric current, and entirely surrounded by a hollow cylindrical yoke of iron. This yoke is divided symmetrically at the middle and the lines of induction act on this gap together with other attractive forces. If now the top portion of the yoke is rotated about the specimen as a vertical axis, and slides steadily on the lower portion of the yoke, then the torque may be measured, or the angular displacement between the zero and pointer be read while sliding is occurring. To elimate the friction pull previous to magnetisation, the pointer is adjusted to read zero under mechanical friction only. Consequently when the specimen is magnetised the magnetic pull is taken up on the surfaced faces and the angular displacement is due to the magnetic induction only. Therefore the magnetic induction in the test specimen can be obtained by multiplying the square root of the reading by a constant. Owing to the completeness of the magnetic circuit, tests at high inductions can be made, and the results agree closely with ballistic tests besides possessing the advantage of great rapidity.

The Electrical Conductivity of Light Aluminium Alloys.

By Prof. Ernest Wilson.

Section G. (Abstract.)

The last report on the exposure tests of a certain series of light aluminium alloys was made in 1908. The present paper includes tests made in July, 1911. The copper series have shown that alloying commercial aluminium alone with copper to the extent of 2·6 per cent. is not to be recommended. The copper manganese specimens have not seriously deteriorated in 10 years. The alloy known as "duralumin" has been tested, and a report is made thereon. Its specific resistance is $5{\cdot}35 \times 10^{-6}$ ohms at 15° C. as against $2{\cdot}76 \times 10^{-6}$ for pure commercial aluminium.

The Single-Phase Repulsion Motor.

By T. F. Wall, M.Sc., M.Eng., A.M.I.C.E.

Section G. (Abstract.)

It is not easy to adapt the methods used for other types of A.C. machinery to the A.C. commutator motor, since this machine partakes of the nature of an alternator and of that of a transformer. The author deals with the subject on lines which he hopes will render the results obtained of immediate use to the engineer. Experimental evidence as to the accuracy which may be expected from the theory is given in the form of tests on a 6-B.H.P. motor. The only assumptions made are that the iron losses and commutation effects are small, and that the permeability of the iron is constant.

Formulæ are established for the maximum values of the flux linkages of the stator winding, due to an alternating current in that winding and due to an A.C. in the rotor winding, and of the rotor winding due to alternating currents in the stator and rotor windings, as well as of the E.M.F. induced in the rotor winding when rotating in the field due to an A.C. in the stator winding.

The author then utilises these in a detailed examination of the mutual reactions of the stator and rotor, with the aid of numerous diagrams, and constructs a circle diagram from which the current, power factor, speed, power and torque of the motor can be deduced, first when the resistances and leakages of the stator and rotor windings are neglected, and, secondly, when these are taken into account, the diagram being correspondingly modified. Lastly, the results of calculation and experiment on the motor above mentioned are given, and it is shown that the curves for power factor agree well at the higher, but diverge at the lower speeds; the curves for stator current agree fairly at all speeds. The effect of the circulating currents in the short-circuited coils is shown to be small.

In the last part of the paper a method of determining the open-circuit characteristic is given, taking into account the effects of saturation on the curve of flux distribution in the air gap, and the distortion of the current wave form due to saturation.

DIESEL ENGINE PROBLEMS.

[COMMUNICATED.]

While the steam engine increases its duty per lb. of steam used as the engine becomes larger, there appears to be little or no better efficiency in the case of large than of small Diesel engines. It is difficult to see why this should be so, unless the makers of the Diesel engine do not find it practicable to increase the ratio of expansion. The question may well be examined with a view to fixing ideas in the salient points involved, and endeavouring to trace out the sequences.

In a steam engine, one of the first cares of every steam engineer is to see the cylinder well protected against loss of heat externally. No heat is allowed to pass outwards through the walls if this can be prevented. Two methods are in use to prevent this. First, the cylinder is clothed by some protecting non-conducting substance; in other cases the cylinder is surrounded by a steam jacket which may actually cause a flow of heat towards the interior of the cylinder. This jacket will itself be protected by the non-conducting jacket of the first method.

Both methods aim to prevent the formation of water in the cylinder; the second method is the more effectual, of necessity, and, by accepting the formation of water within the jacket itself, water is prevented from forming in the cylinder, where it is so harmfully effective. Superheating aims to supply heat to the inside of the cylinder in order that the unpreventable outward travel of heat may take place with a minimum production of water in the cylinder, the steam losing temperature only, and not latent heat.

The area of a cylinder end is $d\pi \times d/4$; the area of the wall of a cylinder is $d\pi \times L$: thus, for the end and the wall to be of equal area, the stroke of the piston must be a quarter of the diameter.

Since the cylinder wall is exposed only for a portion of the stroke, this ratio is perhaps approximately secured. As the engine grows larger in size, the tendency is for its cylinder walls to increase at a slower rate than its area. The walls are thus less effective as condensing agents. A cylinder of large volume loses less through its walls than one of small volume. Its ends and its piston area remain of the same ratio to the admitted steam only as regards equal lengths of stroke. But the large engine has a longer stroke, though its stroke ratio may be less. The cylinder end is thus of less ratio to the weight of admitted steam in large than in small cylinders. This is all in favour of the larger engine, and, without further argument, may be accepted as a sufficient reason for the better economy of the bigger engine without calling upon any superior piston speed it may possess to strengthen the argument.

Now, in the case of the Diesel engine, there is a designed loss of heat to the cylinder walls and ends; that is to say, these parts are water-jacketed, not, primarily, in order that they may lose heat, but in order that they may not be destroyed by temperature. Incidentally heat must be lost, but this heat need not exceed the same amount per unit of wall surface, and should therefore, as in the case of the steam engine, be a less ratio of the total heat in the cylinder when this is of large than when it is of small volume, and the economy of the larger engine should be better. It is said not to be so.

If the larger engine does not therefore convert a bigger ratio of its heat supply into work, if it rejects, as seems probable, a smaller proportion of total heat to the jacket water, necessarily either it must burn its fuel less effectively or it must turn more heat away in the exhaust gases.

With equal ratios of clearance volume to total cylinder volume the compression should be alike in all engines, and the bigger engine would have the higher final pressure and temperature. It would, therefore, warrant a greater degree of expansion in order to make use of this. But to get this greater expansion the cylinder must be lengthened relatively to the clearance space, and this would produce a higher initial pressure unless means were employed to keep open the exhaust valve during the first part of the compressive stroke in order that compression may remain the same in degree and expansion may be carried further. We have no information as to whether anything of this sort is done, but

assuming that it is not done, it would serve to explain why Diesel engines are so remarkably alike in their performances.

The original conception of the Diesel engine included the use of finely powdered coal as fuel. This seems to have been quite abandoned, probably for very good reasons. We believe it also included the use of gaseous fuel, and we do not see why gaseous fuel is not used on Diesel principles.

The liquid fuel Diesel engine employs an air spray of 800 lb. pressure to feed the oil into the cylinder. This demands pressure pumps. Why should not gaseous fuel be compressed to this same degree, so as to feed itself into the cylinder with or without any further jet of air? It seems certain that the energy of the gas itself would be quite ample for securing good mixture in the cylinder with the air already compressed therein. With compressed gas thus fed in there would be every reason to expect all the easy combustion which accompanies the oil-burning engine, the gas being fed in throughout a sufficient length of stroke to preserve an even pressure as it burned.

The Diesel engine of the four-stroke single-acting type is necessarily heavy for its power, especially in its crankshaft. The use of gaseous fuel would seem to offer itself as a means of developing the engine on two-stroke lines and double action, with perhaps less difficulty than may accompany the development of the oil-fuel engine on similar lines. It has been objected that the presence of a piston rod would interfere with the combustion of the charge, but with two or more admission points this should be negligible, and in cylinders of large diameter the single admission ceases to be sufficient even with no central rod.

It may, we think, fairly be agreed that the Diesel engine should be extended to use gas, and that, like the steam engine, its larger sizes should ultimately be made to work with better economy than the smaller sizes.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A COMPANY, called the Electric Power Co., which is developing a number of water powers along the Trent and Otonabee Rivers in Ontario, has now been supplying electricity for some months to several townships and large industrial undertakings.

A generating station of about 4,000-KW. capacity, situated near Campbellford, on the Trent River, was the first to be operated. Last month another station at Trenton, at the mouth of the river, where it flows into Lake Ontario, was started up, and is now operating satisfactorily in parallel with the former station.

Current is generated at 6,600 volts, stepped up to 44,000 volts by means of Westinghouse oil-insulated transformers, and transmitted at this pressure on overhead aluminium lines to the various sub-stations, of which there are at present 15 in operation and four under construction. Over 200 miles of 44,000-volt lines are now in use.

The district to be served by the Electric Power Co. extends from Toronto eastwards as far as Kingston, a distance of about 150 miles, and from the shore of Lake Ontario northwards for a distance of about 50 miles. The transmission system of the Electric Power Co. will be uniform throughout the whole area, viz., three-phase, 60-cycle, 44,000 volts, stepped down, in most cases, to 2,400 volts and 600 volts for power, and 220 volts for lighting. A pulp mill at Campbellford making ground wood pulp, is in operation, taking, at present, some 800 H.P., but by the end of this year it will be taking 2,000 H.P.

A paper mill near by has just commenced taking 200 H.P., and will next year require about 600 H.P. The township of Lindsay has just decided to purchase electric power from the company instead of putting down a municipal plant, which was the alternative proposal.

Altogether about 12,000 H.P. is being supplied now, the ultimate capacity of the water-powers to be developed being about 100,000 H.P. The work most recently started by this company is the construction of a power house at Healy Falls, on the Trent River, about five miles above Campbellford, where there is a head of 76 ft.

The immediate installation at this station will consist of two 3,750-K.V.A. 6,600-volt three-phase 60-cycle generators driven by horizontal water turbines running at 240 R.P.M. Space will also be available for two more similar units. Two 3,750-K.V.A. transformers will be installed to step up to 44,000 volts.

It is expected that this station will be operating by about September, 1912.

An interruption to the supply, of a rather unusual nature, is reported to have occurred in a certain Ontario town recently. Power is generated about 20 miles from the town, and low water in the river is stated to be the cause of the stoppage, but, to go a stage further back, it appears that the low water is due to beavers having built dams higher up the river, the water being thus held back. The supply company is unable to do anything, owing to the stringent laws which prevent anyone from interfering with the beavers, and an appeal is being made to the Provincial Government for special permission to destroy the dams. Until this is obtained several townships will be in darkness and industries will be held up.

Owing to the recent change of Government in Canada, the recently-formed British-Canadian Shipbuilding and Dock Co., of which Sir Henry M. Pellatt is chairman, is apparently awaiting developments. It was anticipated that from the Liberal Government this company would receive extensive orders for naval construction work, but the views of the new Government on the subject of a navy for Canada do not coincide with those of the late Government.

The Hydro-Electric Power Commission, an Ontario Government institution, has recently obtained powers to supply electricity to farms, and it is intended to interest farmers in the utilisation of electric power. The chief difficulty at present is how to get the current transmitted to sparsely-populated districts, while supplying at best only a small demand, at a sufficiently low cost to make it pay the farmer to use it; the question of the Commission making a profit does not arise, as none is looked for.

Many readers of the ELECTRICAL REVIEW no doubt know something of this Commission, but a few explanatory remarks may not be out of place here.

In 1905 three Commissioners were appointed by the Ontario Government, and in 1906 they were granted powers to inquire into the question of the utilisation of the water-powers of the Province for hydro-electric power.

In 1908 an agreement for 10 years was made between the Commission and the Ontario Power Co. of Niagara for the supply of electricity, the maximum requirements of the former being stated as 100,000 H.P. At first it was intended that the transmission voltage should be about 60,000, but later this was altered to 110,000, the highest in the world. The latter voltage has been adopted, and three-phase current at 25 cycles is now being transmitted on overhead lines, some 300 miles of which will be required altogether; about half of this length is in operation now.

Electrical energy is supplied to municipalities, villages, &c., at cost, as the Ontario Government does not intend to make any money out of the scheme.

Further details of the work recently carried out by the Commission, and the general progress and prospects of the undertaking, will be available shortly in a report which is to be published.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Olympia Electrical Exhibition.

In the Electrical Exhibition supplement of your current issue, you again raise the point of the supply authorities failing to purchase and distribute admission tickets. I do not know whether it is clear to you that these tickets had to be paid for whether used or not, and it seems natural under these circumstances that the supply authorities, whose business position is different from that of the manufacturing exhibitors, should be cautious in their purchase of tickets.

The undertaking with which I am connected, and I believe many others, would have been prepared to issue large numbers of tickets and pay a reasonable price for those presented, but the Executive Committee, with its complete

change from the policy of the Manchester Exhibition, has apparently eliminated the right as well as the wrong class of visitors. Many exhibitors may also feel that the high price of space should have obviated the keen seeking after gate money.

Your article admits, what has also been the subject of keen criticism elsewhere, that the Executive Committee, in spite of the assistance of organising managers, have miscalculated the necessities of the case.

Although present on the second day of the Exhibition, I was, unfortunately, only able to visit it again on Wednesday this week. As a result the letters enclosed were written :—

(*a*) To the other exhibitors of arc lamps.

(*b*) To the members of the Executive Committee.

Justus Eck.

London, S.E., *October 6th*, 1911.

Is the Arc Lamp Superseded?

Dear Sirs,—The approach to Olympia Electrical Exhibition is lit by arc lamps, but it only leads up to a paltry display of glow lamps and two small projectors lighting nothing.

The gas industry are doubtless already laughing at the inadequate lighting, and satisfying shopkeepers and factory owners of the inferiority of all electric lamps to the modern high power gas unit.

As fellow-exhibitors, we suggest that all arc lamp firms should press the Exhibition Executive to at once improve the exterior illumination, and to offer to supply all or part of a sufficient number of lamps to illuminate the front of the building free of charge, provided the lamps are properly wired and maintained at the expense of the Exhibition.

We are making such an offer by this post.—Yours faithfully,

Union Electric Co., Ltd.

October 5th, 1911.

Unattractive Olympia.

Dear Sirs,—The exterior of the Electrical Exhibition is undoubtedly dull and unattractive, as the selected glow lamps combination is ludicrously insignificant.

At the inaugural dinner, Mr. Hirst expressed regret at the absence of a "flood of light," and, no doubt, the gas industry are pleased at the present dreary appearance.

We are willing to lend, free of charge, eight (or possibly more) Excello intense flame arc lamps to assist in lighting the front, provided they are immediately put to use, properly trimmed, and regularly used after dark during at least the last two weeks of the Exhibition.—Yours faithfully,

Union Electric Co., Ltd.

October 5th, 1911.

[We believe we are correct in stating that, while better external lighting would be desirable, it is impossible to obtain the necessary supply of electricity for that purpose. —Eds. E.R.]

Charging Ignition Cells.

In your issue of September 29th "E.C.E." criticises the charging of small ignition cells from end regulating cells on three grounds.

With regard to No. 1 objection—*i.e.*, that of the possible shortening of the life of the end cells—in some stations (I am pre-supposing ten or a dozen cells on the positive and negative ends) these said cells do not get enough taken out of them to keep them in good condition ; here is an opportunity to keep them so. It is only a question of looking after a battery as it should be looked after, and not allowing it to be looked upon (as in some stations I could mention) as a "negligible quantity."

Objection No. 2. Not so much constant attention is required as "E.C.E." seems to think, as it may only be necessary to vary the rate of charge when the end cells are put on or taken off charge.

Thirdly, "E.C.E." says that separate regulating resistances have to be rigged up if different sizes of cells are to be charged ; this is also required if charging is done through a bank of lamps (extra charging circuits being required). Large motor-car lighting accumulators can be charged through a larger resistance on the end cells of the opposite pole of the battery. Just think of the C^2R losses in charging a portable accumulator for 10 hours at a rate of 15 amperes through banks of lamps, arc lamps, or a water resistance from a 230-volt circuit (the charging units being in the ratio of 40 to 1 in favour of the end cell method). As the greater part of the business in small ignition-cell charging is done in the lighter months, it is not always possible to make use of the light, as suggested by "E.C.E." ; or if the lamps are out of view, as in such places as condenser-pits or basements, it is possible for some person with an experimental turn of mind to substitute higher candle-power lamps or incidentally short-circuit lampholders.

I may say that I have used the end-cell method of charging small cells, and also for meter testing, for several years, and have not found it prejudicial to the cells.

P.

Trade Discounts to Private Consumers.

The correspondence published by Messrs. William Coates and Son in your issue of September 29th raises an interesting side issue. They write of a rule "that if a customer selects fittings for himself, the manufacturer inquires who is the contractor and sends the account to him with the discount taken off." Where does this rule exist, except in Messrs. Coates's brain ? Surely the contractor must earn a trade discount by some service or recommendation !

Let us assume what may in fact have taken place here : that Messrs. Coates advised their customer to go to Messrs. A. & Co., or B. & Co., to select fittings ; their customer, however, for reasons of his own, or on the recommendation of a friend, goes to X. & Co. Messrs. X. & Co. have thus got the order, not through any service of Messrs. Coates, but literally in spite of them. Would Messrs. Coates seriously expect to receive any consideration from Messrs. X. & Co. ? and, if so, on what ground ?

It appears to us that, in offering Messrs. Coates 10 per cent., X. & Co. acted generously, and that Messrs. Coates quite deserve the snub they finally got for pressing a claim for further consideration.

Another Manufacturer.

With reference to the letter from Mr. C. G. Fox in your last issue *re* above, as he is evidently not a contractor, I should like to point out to him that the price of wiring is cut very fine, and that we often have to depend on the trade discount to pay for carriage, wiring and fixing, which does not leave much for profit, even with a liberal trade discount, unless our customer happens to place a large order with one manufacturer. Perhaps Mr. Fox is under the delusion that a trade discount arranged by the manufacturers is meant for any trade. I was once asked by a wine merchant what discount I would give him off fittings, and when I told him the same as he gave me off whisky, he said no more.

As to Mr. Fox's last paragraph, I presume he is not a business man, and, for his information, I would like to explain that before manufacturers invoice goods they obtain a written order. We have no objection to the manufacturer dispatching and invoicing to our customers orders direct, providing they credit us with the full discount to which we consider we are entitled. It is quite another matter if we wish to split the discount or profits with builders and ironmongers, &c. I should consider myself very lucky if I made a 10 per cent. net profit on my turnover, including the interest on my capital and my personal labour.

A. F. Lord.

Plymouth, *October 9th*, 1911.

The Evolution of Wiring Systems.

I have read with interest an article on the above by "J. W. B.," and must say that this does not seem to be up to your usual standard. The article, in the first place, is very misleading. As regards the cost, there is a table of costs per point, complete with tungsten lamps. The tungsten lamp might cost 2s. 6d., 2s. 9d. or 4s., and, of course, this would considerably alter the cost of wiring. The writer does not specify which he means, so that the value of the table is practically nil.

Assuming that the lamp was an average one, which should cost 2s. 9d., the cost of an installation per point in screwed seamless conduit would be 19s. 3d., in brazed conduit with continuity fittings 18s. 3d., and in close-joint slip conduit 15s. 3d.

To go no further, it would be pleasant to know where

prices of this sort can be obtained for installation work. The average contractor should be able to tell the author something about competitive prices which would astonish him. Such prices as these were obtainable some years ago, but we would suggest that 14s. 6d. for screwed, 12s. 6d. for brazed and 10s. 6d. for close joint are about the average prices for installation work in small houses in practically all the chief towns in England. He also states that enamelled wire for the insulation of lighting leads is quite a new system, but surely he must be aware that nearly five years ago this wire was put on the market by Messrs. Connolly Bros., and has been used for this purpose ever since, although not extensively.

As No. 10 system he mentions heavy rubber ("cab tire") as being a comparatively new form of cable. One might admit that the name is; but this cable, in the kindred forms of hard cord special flexible and metallic-braided flexible, has been in use for more than seven or eight years, and certainly these are very adaptable cables for hand lamps, cooking circuits and radiators.

With reference to No. 8 system, it might be pointed out that the price of 10s. for this method with non-Association cable is also very excessive. The cost of this wiring, inclusive of a 2s. 9d. metal-filament lamp, as quoted by some of the companies who specialise in wiring in small towns is 6s. 8d. It might be pointed out that this system seems to be coming into vogue, and affords considerable advantages over others, owing chiefly to the simplicity of installation and the cheap cost of running. Of course, it is more generally used in works and mills, owing to objections from an artistic point of view; but if the wiring is installed with suitable decorations, such as painting the wires, and using tinted cleats, these objections are largely overcome. The system has also been very much handicapped by want of special fittings, but latterly several of these have been placed on the market, which facilitate this class of wiring.

As regards the cost of surface wiring in works and mills, some astonishing results have lately been obtained. In one mill installation of fair size, the price of a surface system fitted with ordinary switches and fuses and V.B. cleat ceiling roses, complete with switches, flex, fuseboards, mains and carbon lamps, ran out at 3s. 10d. per point. In another case it was found that a wireman and his mate working on a surface system, and using the V.B. cleat ceiling rose, fixed 50 lights per day, which means that the labour was roughly 3d. per point. The chief difficulty which this system has encountered is not mentioned in your article—the insurance companies—and these companies have probably done as much to keep surface wiring back as they possibly could, and the still more curious fact is that in some of the Colonies they are even more opposed to it than they are in England.

However, insurance companies now seem to be realising that a properly installed surface system gives as great a security as any other method, and in very many cases a higher insulation test. It may be mentioned that only a short time ago Messrs. Bonnella Bros. erected a large factory off Tottenham Court Road, which they wired with braided wire on the surface wiring system, using modern fittings, and that this was connected to one of the supply companies' mains, and also insured at ordinary rates by a first-class insurance company.

An Electrician.

CONSUMERS' FAULTS.

By H. H. JOWERS.

A great difficulty which a mainsman has to deal with is that of small "earths" which occur from time to time on consumers' installations. These are first noticed by the recording ammeter in the earth circuit, and remain on for just a few hours in the evening. Now, the difficulty arises in locating these. It may be done in the case of a three-wire system by putting the opposite pole to that which the earth is on, to earth potential, and thus trying to break the fault down, but this is a dangerous practice, especially during the hours of load, for it may break down other installations which are not quite up to standard, and cause, as in cases known, a fire, or public buildings to be plunged into darkness, besides which it is a most clumsy method, and one which would not appeal to the engineering side of the mainsman.

The method which the author has found successful is that of having a test bar running the whole length of the feeder panels, which, by means of switches, can be switched on to any feeder (see fig. 1); a motor-generator, or a small steam set, is run up until the current is equal to that of the load on the feeder which is to be first switched over, the distributors having been previously divided into sections, each feeder supplying an independent section; the feeder switches are then opened, and the one section comes over on to the test-bars. As this is then an independent supply, it is readily observed if the fault remains; in this way the section can be found in a few minutes. When it is found, it is simply a matter of transferring lengths of distributors until the faulty length is identified; the consumers on this length are then tested the following day, and the fault is readily localised.

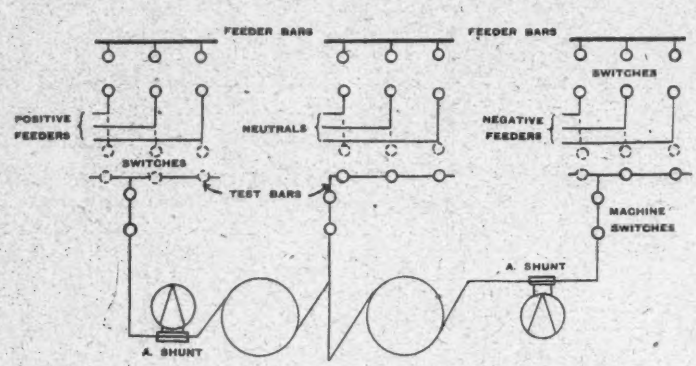
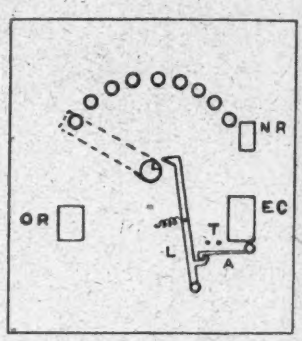


Fig. 1.



N R, No-volt release coil; O R, Overload release coil; E C, Earth coil.

A current going to earth energises the coil E C, which draws up the armature A, short-circuiting the two terminals T, which short-circuit coil N R, and at the same time releases lever L, which locks the starter handle in the off position. The starter is semi-enclosed, the cover being under seal.

Fig. 2.

The above is for faults on lighting installations; the same trouble, of course, is experienced with motor users, and the same method can be applied for localising these. The author has, however, applied an additional method for locating "earths" on motors, and this is more especially necessary in the case of motors which are let out on the hire system, where the motors are maintained by the supply authorities, and it is necessary that greater care be taken of the plant. With motors properly wired and "earthed" the fuse would immediately blow, but this often leads to damage to the motors due to the fact that stronger fuses are put in to try and remove the trouble; also in some cases the author has found the earth wire either cut or disconnected when the fuse has blown. The method used by the author is that of placing a small coil in circuit with the "earth" as shown above in fig. 2; this releases the starter handle by short-circuiting the no-load release coil, and at the same time locks the handle of the starter in the off position, so that an inspector from the

power station has to be called before the motor can be restarted, the starter case being under seal. This method undoubtedly keeps the maintenance figure of the motor-hire system low, for faults can be rapidly removed at a low cost whilst in their initial stage, and not allowed to develop into more expensive jobs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Rail Insulators.

Messrs. Doulton & Co., Ltd., of Lambeth, London, S.E., have long made a speciality of stoneware insulators for various classes of electrical work, and one particular section of this department

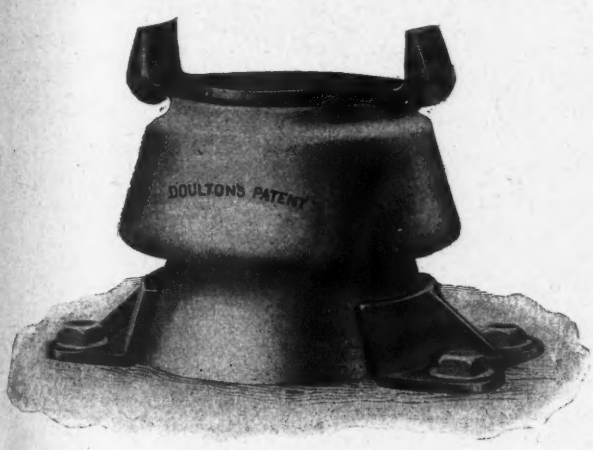


Fig. 1.—"Pedestal" Type Insulator.

of their business has been devoted to electric railway requirements. An example of third-rail insulators is illustrated herewith (fig. 1). It is the Pedestal third-rail type that has been supplied for most of the railways electrified in this country, including the N.-E. Railway, L. & Y. Railway, G.W. Railway, Metropolitan, London, Tilbury and Southend, and Mersey systems.

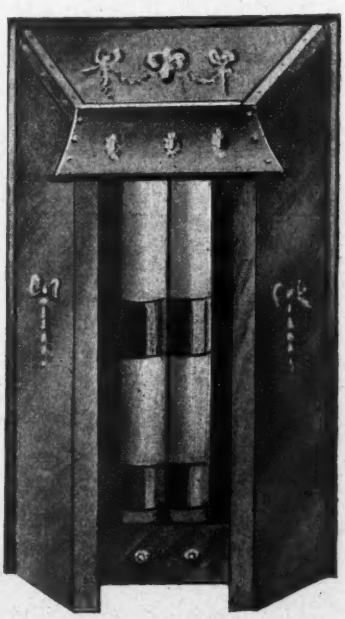


Fig. 2.—Dowsing Tubular Radiator.

The same type is now being supplied for the refitting of the Metropolitan District Railway. It is made to carry a flanged rail or rail of rectangular section, it has malleable cast-iron fittings, and is made to suit various sections and widths of rail. The "Pedestal" insulator is also made to carry rails of inverted channel section. The "Tubular" type of insulator is employed on all the tube lines of the London Electric Railways Co. It consists of a block of cream-enamelled stoneware of tubular or multitubular form, grooved to receive the rail, and resting upon the sleeper, to which it is secured by clips. Messrs. Doulton, of course, also make all types of insulators for high and low-tension work, both in white porcelain and in stoneware, to standard and to special designs.

Dowsing Radiators.

The Dowsing Radiant Heat Co., Ltd., of 105, Great Portland Street, London, W., have a number of new designs among their electric radiators for the present season. One of these of quite artistic type, is illustrated in fig. 2. It is the firm's type 1,003 double-tubular radiator, with a gilt lacquered frame, patent copper interior and reflector, and four luminous heat lamps. It is 36 in. high, 21¼ in. wide, 6½ in. deep and weighs 13 lb. Fig. 3 shows a cheap combined radiator or radio-convector, on the Dowsing-Huntley system, with a block-iron frame and copper reflector. It

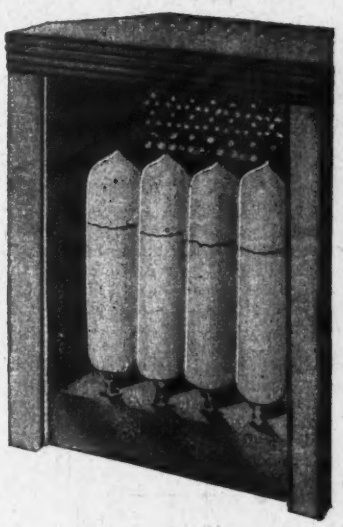


Fig. 3.—Combined Radiator.

has four luminous heat lamps, and is also fitted with non-luminous heaters. It measures 19½ in. high, 18¼ in. wide, and 9 in. deep, and weighs 18 lb. Numerous other designs are shown in the new season's price list just issued. Electric flat-irons and cookers for household service are also supplied.

LEGAL.

Johannesburg Council *v.* D. Stewart & Co. (1902), Ltd., and Wm. Beardmore and others.

Judgment has been given in the Scottish Court of Session in this action. Decree is given by Lord Ormidale for sums amounting altogether to £340,177.

The action was raised in respect that the defenders, Messrs. Stewart & Co., had abandoned and failed to implement contracts entered into by them with the Municipal Council of Johannesburg for the installation of electrical plant, gas producing plant and gas engines for the city of Johannesburg for tramways, lighting and power purposes. Messrs. Stewart & Co. denied the breach of contract, and stated that the installation was made according to the specification of the pursuers, and that any failure of the installation to reach the prescribed tests was due to unsuitability of coal supplied by pursuers to the defenders, Messrs. Stewart & Co., for gas producing purposes. The defender, Mr. Beardmore, was guarantor for the performance of the contract by the other defenders, his liability being limited to the amount contained in a bond, viz., £115,134. The balance of the sum sued for was £145,000 for repayment of the part of the purchase price paid to Stewart & Co., and about £200,000 for damages for breach of contract. The proof in the Scottish Court occupied about a month, and the productions in the case numbered fully 14,600.

Lord Ormidale finds and declares in terms of the declaratory conclusions of the summons, decerns against the defenders, D. Stewart & Co. (1902), Ltd., and the defender, William Beardmore, jointly and severally, for payment to the pursuers of £115,134, with interest at the rate of 4 per annum from July 1st, 1909, until payment, reserving to the defender, William Beardmore, such right of relief against the defenders, D. Stewart & Co., Ltd., as may be competent to him. Further, his Lordship decerns against the defenders, D. Stewart & Co. (1902), Ltd., for payment to the pursuers of, first, £27,961, with interest at the rate of 4 per cent. per annum, from July 1st, 1909, till payment; second, the sum of

£127,907; and, third, the sum of £69,175, with interest on the sums of £127,907 and £69,175, at the rate of 5 per cent. per annum till payment. The Judge finds the defenders, other than Mr. Beardmore, liable jointly and severally to the pursuers in expenses. His Lordship said that the question in fact he had to decide was whether the contractors repudiated their contract. His Lordship held that they did. The plant and machinery were not in a condition to allow the stipulated tests to be carried out, and on the back of that admission they threw off the contracts and ceased working. He had no doubt that the pursuers were entitled to treat the contracts as at an end, and this, his Lordship thought, was what they did substantially as from the date of the contractors' abandonment or repudiation. The contracts having been repudiated by the defenders, and the pursuers having accepted that repudiation, the latter were entitled to reject the plant, which was not up to the contract, and to claim damages. The next question was, what was the position of the sureties? His Lordship held that on the view he took of the contract, it appeared to him the sureties were liable under the bond. The contractors not having in all respects duly and punctually performed the agreements, &c., in the contracts, their failure in performance was absolute and complete, and therefore the sureties were liable to the full amount of the money obligations undertaken by them.

[We hope to allude to the above matter in our next issue.]

Overhead Wires.

On Monday, at the Lambeth Police Court, Mr. Hopkins, sitting as arbitrator under the Telegraph Act, 1878, gave his decision on the case between the Postmaster-General and the Southwark Borough Council on the refusal of the latter to consent to the erection of overhead telegraph wires in certain streets in the borough. As reported in the *Times*, Mr. Hopkins said that the argument that three fire-alarm posts in an obscure corner of the Borough of Southwark should not be electrically connected to an adjacent fire station, except at a cost of £340, was, to his mind, a position which could not be successfully maintained. He had walked over the streets, and had been quite unable to discover any reason for apprehending danger, disfigurement or inconvenience. His award was that the Post Office should be at liberty to carry the necessary overhead wires in accordance with their plans.

Damages against the L.C.C.

In a case heard at the Westminster County Court on Monday, a boot worker named Jass was awarded £28 18s. damages against the L.C.C. for injuries sustained owing to the sudden restarting of a car during a rush to board a tramcar at the Old Street and City Road junction. Plaintiff's counsel said that when the conductor was taking fares at busy periods of the day extra men were needed to signal for the starting and stopping of cars.

BUSINESS NOTES.

The Question of Preferential Contractors.—The practice of allocating contracts always to one firm was referred to at the recent meeting of the Hamburg Electricity Works Co., when a shareholder, in drawing attention to the impending extensions of the works at a cost of £750,000, pointed out that the Siemens-Schuckert Works Co. had hitherto always received orders for the whole of the work, the reason being, as he had heard, that the company held most of the shares. Nevertheless, the other firms also supplied satisfactorily, and the electricity works should, therefore, select open competition. In reply, one of the directors stated that the Siemens-Schuckert Works had not received the orders on account of shareholding, but solely because the State of Hamburg desired their participation, and also had an interest in the delivery of faultless machinery. As a matter of fact, the deliveries of the company had met all requirements. The shareholder thereupon declared that he failed to understand what interest the State could have in the internal equipment of the works, but his request for information met with no response.

Australian Mica.—The Western Australian Government *Gazette* of August 25th, publishes the text of regulations, dated August 22nd, for the payment, for two years from that date, of subsidies in encouragement of the production in that State of dressed mica and manufactured mica goods from crude mica produced in Western Australia. Subsidies will be payable as follows:—(1) One-half the cost of transport of mica from the mine to the place of manufacture or export, up to 3s. per cwt.; (2) 10 per cent. of the selling price of mica sold at not less than 2s. per lb.; and 15 per cent. of the selling price of mica sold at less than 2s. per lb. The total subsidies payable to any one firm are not to exceed £250 per annum.—*Board of Trade Journal.*

Rubber Exhibition in New York.—Mr. A. Staines Manders, organising manager of the Rubber and Allied Trades Exhibition recently held in London, has cabled from America to state that a rubber exhibition will be held in the Grand Central Palace, New York, in September of 1912.

Vacuum Recorder.—Referring to the exhibit at Olympia which we noticed last week of a vacuum recorder "which is the first placed on the market for this purpose," Messrs. Thermo and Pressure Instruments, Ltd., of 60, Salusbury Road, N.W., point out that the "Fournier" vacuum recorder, based on the pressure of saturated vapours, has been on the market for a short time already, and has shown its value in application at various electricity generating stations.

Stoker Contract.—We learn that Messrs. Erith's Engineering Co., Ltd., have received the order of the Bolsover Colliery Co., Ltd., for 24 more of their grateless stokers, complete with their system of automatic response of fuel and air to varying loads. This is their ninth order in seven years, completing 88 Erith's stokers for this one company, who also heat and soften their water by the same maker's "no lime" process in Erith's heater-softener.

Electric Haulage on Rivers and Canals.—The chief engineer of the Special Service of Navigation between Belgium and Paris, 5, Rue de l'Aigle, Compiegne (Oise), France, is inviting tenders until March 1st, 1912, for the concession for the establishment and working of a system of electric haulage of the boats on the Haut-Escaut River, between Etrun and Janville, on the St. Quentin Canal, and on the canal at the side of the River Oise.

Book Notices.—*Report on Rating of Electrical Machinery.*—We have received a copy of the above report, which, the preface informs us, has been drawn up to assist the Electrotechnical Commission in the study of the international rating of electrical machinery. The report was specially mentioned by Prof. Elihu Thomson in his address to the I.E.C. at Turin, and has been referred to the small International Committee formed to study the rating of electrical machinery, which, indeed, is one of the most important objects for which the Commission was instituted. The report is limited to continuous-current machinery, and contains extracts from the standardisation rules in vogue in Belgium, France, Germany, Great Britain, Sweden and the United States of America. It shows that international agreement as to rating and general tests should not prove so difficult to tackle as was anticipated. Besides giving in a simple and clear manner the recommendations of the different countries with regard to power, service recognised or rating, as we call it, heating, overload, efficiency, dielectric tests, &c., an appendix is added giving the latest information issued by the American Institute with reference to the resistivity of copper, and also an interesting table of tolerances as regards guarantees employed in France. Altogether it is an interesting production, and well worth study by engineers and manufacturers, for it not only shows the lines upon which international agreement is likely to be obtained, but in the meantime can be of use to anyone specifying continuous-current machinery. The report is to be obtained from the general secretary, 28, Victoria Street, Westminster, at the price of 4s. 2d., post free.

"Charter, By-Laws and List of Members of the Iron and Steel Institute, 1911." London: The Institute. Price 1s.

"Motor Cycling Manual." 1911. London: Temple Press, Ltd. Price 1s. 6d. net.

"Science Abstracts." Sections A and B. Vol. 14, Part 9. September 25th, 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVII, No. 7. September, 1911. New York: The Society.

"Catalogue des Instruments Mathematiques et Scientifiques. Exposition Universelle de Turin, 1911." (Section de la Grande Bretagne.) London: Eyre & Spottiswoode, Ltd. Price 50 centesimi.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. II, Part 7. August, 1911. Johannesburg: The Institute. Price 2s.

"Boilers and Boiler Control." By John B. C. Kershaw. 1911. London: Davis Bros. Price 1s. net.

"Alternating Currents." By Dr. Alfred Hay. Third edition. 1911. London: Harper & Bros. Price 6s. net.

"The Electric Propulsion of Ships." By H. M. Hobart. 1911. London: Harper & Bros. Price 5s. net.

"Multiplex Telephony and Telegraphy by means of Electric Waves Guided by Wires." By Major G. O. Squier. 1911. Chicago: From the Author.

"Quarterly Bulletin of the American Institute of Architects." Vol. XII, No. 2. July, 1911. Washington: The Octagon.

"A Study of the Current Transformer, with particular Reference to Iron Loss." By P. G. Agnew. 1911. Washington: Government Printing Office.

Bankruptcy Proceedings. — Cuthbert Fenton Lindop, electrician, 16, Moss Lane, Aintree, Liverpool, late of 62, Dale Street, Liverpool.—Mr. Registrar Cooper held a sitting at the Court House, Government Buildings, Victoria Street, Liverpool, last week for this adjourned public examination. The case was adjourned owing to the non-production of documents.

W. H. Ridpath (Ridpath & Wells), electrical engineer, Ilkeston.—First and final dividend, 1s. in the £, payable October 17th at 5, Victoria Buildings, Derby.

G. V. B. Barker, electrical engineer, Roundhay, Leeds.—First and final dividend of 5s. 6¼d. in the £, payable October 16th at Official Receiver's office, The Red House, Duncombe Place, York.

W. F. Flint, electrical engineer, Jameson Street, Hull.—A meeting of creditors was held at Hull last week. The gross liabilities were returned at £1,785, and the assets at £639, leaving a deficiency

of £1,105. The debtor, who commenced business three years ago with a capital of £270, attributed his failure to heavy losses on contracts, keen competition, and bad debts. A trustee was appointed with a committee of inspection. Trustee, Mr. W. G. Hall, Silver Street, Hull.

Trade Announcements.—Messrs. E. E. Porter & Co., Ltd., 14, Canton Road, Shanghai, who have been established for very many years as electrical contractors in Shanghai—we understand that they were the first to open out there—are desirous of receiving quotations for general electric light and bell accessories and fittings for the coming year.

Messrs. J. Dodimead & Son, of 50, Tottenham Court Road, W. (whose senior partner, Mr. J. Dodimead, recently passed away, as already stated in our pages), announce that the business is now being carried on by Mr. Charles E. Dodimead, the son of the deceased gentleman. The title of the firm will not be changed.

Mr. Percy Pitman, of Acton, has registered the following telegraphic address: "Hydromotor, London."

Mr. H. G. Frost, late of Deal, has taken over the business of Messrs. T. Stone & Co., electrical engineers, &c., High Street and Bank Street, Gravesend.

The North-Western Electrical Appliance Co., formerly of Glasgow, have removed to new and up-to-date works at Darlington. They have recently experienced a rush of business. Their address is now Railway Appliance Works, Darlington, Co. Durham.

The London Brass and Aluminium Die Castings Foundry, Banner Street, E.C., are now fully equipped for undertaking the manufacture of die cast parts for patented articles.

Messrs. Brotherton Tubes and Conduits, Ltd., have removed their stores from Bennett's Yard, Marsham Street, to Brewer's Green Yard, Victoria Street, London, S.W. The change is consequent upon increased business, and the new premises are more commodious, enabling orders to be promptly handled.

Mr. Leoline Edwards, of 81, St. Margaret's Road, Twickenham, has taken over the sole agency for London, and the South, the Eastern and Western districts of England and South Wales, for the Broughton Copper Co., Ltd., for all electrical goods manufactured by them. He has sent us a price card of standard stock sizes of patent forged copper cable sockets for electrical connections.

Catalogues and Lists.—Messrs. Litholite, Ltd., 55, Hackney Grove, London, N.E.—New sheets (13, 14 and 15), replacing others already in their catalogue, regarding standard Litholite caps and insulators. Three new sheets (24, 25 and 26) are added showing some new patterns of handles, insulating bolts, &c.

The Abbey Electric Co., 17, Victoria Street, Westminster, S.W.—Two pamphlets showing and pricing the "Abbey" enclosed arc lamp, and flame lamp.

The Midland Electric Manufacturing Co., Ltd., Stafford Works, Rea Street South, Birmingham.—Pamphlet (illustrated) of 40 pages showing, and clearly setting out prices of, a variety of switchgear, including various patterns of ironclad switches and fuses, fuseboards, motor-control and supply panels, distribution switch and fuseboards, and accumulator switchboards.

The Electro-Mechanical Brake Co., Ltd., West Bromwich.—Illustrated list relating to their patent unbreakable and jointless grid resistances.

The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—A number of cards have been received illustrating and briefly describing the Prometheus domestic kitchen range, electric ovens, steamers, boiler and stock pot, pastry oven, Bain Marie, hot cupboard and carving table and hot press, for hotel and restaurant kitchens.

The Cambridge Scientific Instrument Co., Ltd., Cambridge.—List No. 92 (24 pages), containing detailed descriptions, including suitable exterior and sectional views, also line diagrams, of their tilted electrometer, simple micro-electroscope, Universal portable electrometer, string electrometer, Dolezalek quadrant electrometer, radio-activity measurement apparatus, the Weston normal cell, and silver voltameter. A separate leaflet (No. 90) similarly describes Callendar's apparatus for the determination of "J," the mechanical equivalent of heat. Prices and code-words are given in both lists.

The A.E.G. Electrical Co., of South Africa, Ltd., Caxton House, Westminster, S.W.—A batch of literature has been received as follows:—A 32-page brochure, containing a full description, with many half-tone and line illustrations, of the hydro-electric plant of the Adamello Electric Supply Co., which is utilising hydraulic power in the Camonica Valley for supplying energy to other companies and consumers in the provinces of Brescia, Bergamo, Milano, Como, Piacenza, Parma and Cremona; a 20-page pamphlet effectively showing in colour, a number of fittings for high candle-power metallic-filament lamps, and street spanning and lamp lowering devices; 16-page pamphlet, describing the differential protective system for the protection of cables and transformers; the A.E.G. *Journal* for September; and the full catalogue of A.E.G. meters (92 pages) of which mention has already been made in our columns.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, London, E.C.—16-page catalogue (N 80) containing illustrated descriptions and prices of the "Globe-Nadir" electric measuring instruments, including the universal testing set, portable galvanometers and ohmmeters, metal-filament lamp testing apparatus, thermo-electric pyrometers, recording pyrometers, switchboard and portable ammeters and voltmeters, and standard resistances.

The Electrical Engineering and Agency Co., Ltd., 109-111, New Oxford Street, London, W.C.—Two leaflets, one giving illustrations, prices and other particulars of Riding's flame arc lamps and enclosed lamps, also resistances and choking coils; the other contains fully illustrated information and prices of arc lamp raising and lowering gear and accessories.

The Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham.—Four lists, the contents of which consist almost entirely of fully tabulated sizes, weights, shipping dimensions, prices, and so forth, of the following: List M 2, two and three-phase induction motors, 4, 6, 8, 10 and 12 poles respectively; M 1, continuous-current motors and dynamos, variable speed and reversible interpole motors; M 3, continuous-current motor starters, ironclad motor-starting panels and shunt regulators; M 5, motor-generators, single field rotary transformers, small rotary converters and induction motor-generators. Copies can be obtained on application.

Messrs. Medway's Safety Lift Co., 10, Bush Lane, Cannon Street, London, E.C.—12-page booklet describing Scott's patent system of automatic push-button control for electric lifts, also Scott's car switch and semi-automatic push-button control. Copies will be sent on application.

The Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.—New catalogue (24 pages) containing illustrated descriptions and prices of a variety of lanterns and fittings for street, shop and works lighting. "Streetlites," ventilated cluster fittings, sign and shop-window types, "Beatark" type fittings, Barrow suspension devices, watertight fittings, "Deflectorlite," "Onelite," and "Drawlite" fittings, brackets, &c.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham. Mailing card showing their Simplex hair dryer.

The Weston Electrical Instrument Co., Audrey House, Ely Place, London, E.C.—Manifold list illustrating and briefly describing a complete line of Weston A.C. switchboard indicating instruments.

The Unbreakable Pulley and Mill-Gearing Co., Ltd., West Gorton, Manchester.—New pocket edition (twenty-fourth) of their catalogue, of over 100 pages. The first 10 pages are occupied with useful tables for engineers and others, and a telegraphic code follows. Illustrated descriptions with prices are then given of various shafts and couplings, bearings, clutches, pulleys, &c. Among the new contents is information regarding the following: Ball, roller and forced lubrication bearings; heavy bearings for main drives; Reny flexible coupling; the Benn friction clutch and actuating gears.

Messrs. Brotherton Tubes and Conduits, Ltd., Commercial Road, Wolverhampton.—We have received a finely got-up and well-bound catalogue (No. 6) of 180 pages, in which are fully illustrated descriptions, with price information tabulated clearly on facing pages, of their "Excelsior" electrical conduits and fittings. A series of excellent photographic views of the different departments at the works precede the general catalogue information, and the latter is followed by a number of generally useful features such as wiring rules, Board of Trade regulations, Fire Office rules, table of conductors, and particulars of electric light and power stations at home and abroad. The catalogue should be interesting and useful to contractors and exporters.

Dissolutions and Liquidations.—Lahmeyer Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. C. Pfeffer, 135, Oxford Street, W.C., as liquidator. A meeting of creditors is called for October 19th.

Amalgamated Radio-Telegraph Co., Ltd.—A meeting is called for November 10th, at 58, Coleman Street, E.C., to hear an account of the winding up from the liquidators (Messrs. F. W. Pixley and H. Allen).

Doncaster Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. A. E. Stringer, Cheapside Chambers, Bradford, as liquidator.

Solium Electrical Co., Ltd.—Mr. E. Harlow, 33, King Street, Nottingham, the liquidator of this company, notifies that he is now in a position to pay all creditors in full. Action was taken against the vendor of the process (Mr. A. Hurter, of Oerlikon, Switzerland) for non-fulfilment of contract and damages. Judgment was obtained, which has enabled this distribution to be made.

Machine Tool Association.—We are informed that among recent additions to the membership of the Machine Tool and Engineering Association, Ltd., are the following:—Craven Bros., Ltd.; Hulse & Co., Ltd.; Birmingham Small Arms Co., Ltd.; S. Osborn & Co., Ltd.; Consolidated Pneumatic Tool Co., Ltd.; B. & S. Massey; Roberts Bros.; Hoffman Manufacturing Co., Ltd.; Dron & Lawson, Ltd.; Joshua Heap & Co., Ltd.

LIGHTING and POWER NOTES.

Aldershot.—The U.D.C. has decided to install at the electricity works a Diesel engine of 200 H.P. at a cost of £2,298.

Belfast.—Mr. P. C. Cowan, of the L.G.B., held an inquiry last week relative to the application of the T.C. for sanction to a loan of £40,000 for extending the electric light undertaking. There was no opposition to the applications. The town solicitor

explained briefly the objects of the loan applied for in connection with the electrical undertaking. The amount asked for was made up as follows:—Plant, £12,850; distributing mains, £9,500; feeders, £6,100; services, £8,550; meters, indicators and time switches, £3,000. The city electrical engineer, said, judging from the growth of the demand for electricity during the period 1904-1911, the probable demand for the winter of 1911 would be 4,600 KW., and for the winter of 1912 4,920 KW. The total plant capacity for lighting at present was 7,300 KW., and it was necessary to reserve 1,800 KW. as spare, and for driving auxiliary motors. The available plant was, therefore, reduced to 5,500 KW. In addition to the usual increase they had secured a power consumer of 390 B.H.P., which would add about 350 KW., allowing for efficiency and drop. Adding this to the ordinary estimate for the year 1912, they got a total demand of 5,270 KW. It would, therefore, be necessary to have more plant after that date, and he had allowed for the addition of a duplicate 1,500-KW. turbo-dynamo and condensing plant with spare armatures, and he intended the spares purchased under the last contract to fit the new machines. The existing switchboard would require the addition of five panels—one dividing, three feeding, and one generator panel. The estimate also included one boiler of 20,000 lb. per hour capacity, together with an economiser, mechanical stoker, and pipe-work, the available space in the boiler house being limited to this extent. Witness went on to give further details concerning the plant already in the electricity station, and the new plant about to be acquired, and he quoted statistics showing the growth of the demand for current both for lighting and power purposes. Some of the extensions contemplated were required immediately, but others would not be carried out until there was a guaranteed consumption equivalent to 20 per cent. of the cost of laying the mains. The town clerk remarked that over and above the proposal now before the inspector, the electrical engineer had made a recommendation to the Committee for still further and much more important extensions, with a view to being prepared for some years ahead. The Committee had had the matter before them, but had not yet given it full consideration. In answer to the inspector, Mr. Bloxam said the work done under the loan now applied for would enable them to carry on the undertaking for the next couple of years, and at the end of that time he contemplated the provision of another power-house. The Corporation was satisfied with the progress that the undertaking had made since its initiation. The inquiry afterwards terminated.

Bexhill.—At the meeting of the Council on Monday last, it was resolved to make application to the L.G.B. for sanction to borrow £2,000 being the estimated expenditure necessary in respect of cable extensions, and £400 in respect of house services, during the period of two years from March 31st last.

The B. of T. has issued a report of a preliminary inquiry conducted by Mr. C. Wren Limpricht into an explosion at the Bexhill Electricity Works, which occurred on Sunday, May 14th. The Inspector describes the machinery concerned in detail, and says as regards the cause of explosion: "The explosion was caused by water-hammer action, the water of condensation from the previous run having lodged in the superheater pipes adjacent to the equalising valve, and, being set on motion by the opening of the superheater drain, produced such stresses in the body of the valve as to cause its fracture."

Bispham.—Last week considerable damage was done to the new electric lighting station at Bispham by the gale. The wind veered round in the early morning, and the west wall of the building collapsed. The wall was about 50 ft. long and 22 ft. in height.

Blackpool.—The electrical engineer has been instructed to submit a report and estimate respecting any necessary extensions to the plant for lighting and tramway purposes.

Bradford.—The Joint Electricity and Tramway Sub-Committee of the Corporation, recently appointed to consider the charge for current for tramway purposes, has decided to recommend that the price of electrical energy for tramway purposes this year be 1d. per unit.

An electric cable is to be laid from Apperley Bridge to Strangford, on the Esholt Estate—where sewage disposal works are being constructed for the Corporation—at an estimated cost of £735.

Burnley.—With a view to encouraging the greater use of electricity for power purposes, the Corporation has adopted the following supplementary charges, viz.:—Where the consumption is equal to or above 400 units per E.H.P. per quarter, 1d. per unit flat rate; if equal to or above 500 units per E.H.P. per quarter, '9d.; if equal to or above 600 units per E.H.P. per quarter, '8d.; and where the consumption is more than 600 units per E.H.P. per quarter, a consumer may elect to be charged on the following scale:—A fixed charge of 25s. per E.H.P. per quarter installed, plus a running charge of '4d. per unit for current as metered. The new charges, so far as they affect the present consumers, will come into operation on January 1st, 1912, or after the last reading of their meters if before that date, and as regards new customers on such date or dates as they shall commence to take electricity from the Corporation.

Burton-on-Trent.—The T.C. has decided to extend the supply by overhead cable to Horninglow, so as to supply current to St. John's Church and private consumers in the vicinity. A similar extension is to be made to Bretby Lane. The cost of the extensions is only one-fifth of that of underground cables.

Bushey.—The Electric Light and Tramways Committee reports that it has retained Mr. W. H. Patchell to advise the Council in the matter of obtaining terms from proposed electric light undertakers, and examine and report on the necessary agreement between the Council and the undertakers.

Canada.—Within a very few weeks electrical energy will be coming into the city of Winnipeg from the municipal plant situated at Point Du Bois, which is rapidly nearing completion. It is interesting to note the important industrial development in the Western metropolis of late, owing to this assurance of cheap power in unlimited quantities.

The Hon. Adam Beck, chairman of the Ontario Hydro-Electric Commission, while in Europe during the past summer, purchased a quantity of farm implements and machinery designed to be operated by electricity on the farm. This machinery and the farm appliances have been placed on the provincial Experiment Farm, Guelph, to be put into practical use for ploughing, seeding, drilling, cultivating, digging, &c.

After fully demonstrating the adaptability of the electric current to the amelioration of farm labour, not only at the Agricultural College, but at several private farms, current will be offered to the farmer through the township municipality, at the same, or cheaper, rates than is now given to the Ontario towns and cities.

Continental.—GERMANY.—The T.C. of Munich, has decided on the erection of a new municipal electric works in the Bavarian Oberland, connected with the Leitschach station, near Miesbach. The scheme will be carried out by a trust company composed of Berlin and Bavarian capitalists, and of the share capital of M. 6,000,000 the city of Munich will take 51 per cent.

FRANCE.—To supply the industrial region in the Department de l'Oise, embracing the cities of Beauvais, Clermont, Compiègne and Senlis, two schemes are being put forward. The one proposes to erect a station at Crèil for the supply of the places named, and intervening villages; the other contemplates catering for Creil, Clermont, Beauvais and Meru. MM. Drin & Ferré are the authors of the latter scheme, and the official inquiry has already been made, without the result, however, as yet transpiring.—*Revue Pratique de la Electricité.*

RUSSIA.—According to the Russian journal *Elektritchestwo*, there existed in 1910 in Russia, 156 central stations. Of 111 of these, 81 utilised continuous current, five continuous and alternating current, and 24 alternating current. No particulars are available of the 45 remaining stations. Of the 111 stations, 20 worked at pressures of between 110 and 150 volts; 65 at between 150 and 240 volts; five at between 500 and 600 volts; 26 at between 2,000 and 5,000 volts; and four at pressures between 5,000 and 8,000 volts. 37 works, of which complete particulars are given, have an aggregate capacity of 117,141 KW. Among this number are comprised the four stations at St. Petersburg, having together a total capacity of 41,650 KW. The price for lighting at these 37 stations varies between 40 and 124 centimes per KW.-hour, and for motive power, between 19 and 80 centimes per KW.-hour.

Crewe.—It is proposed to incur an expenditure of £3,602 for new plant in connection with the electricity works. The works are to supply energy to the new County Training College, Crewe Green, and the new postal sorting office in Weston Lane, outside the borough.

Dover.—The T.C. has applied to the B. of T. for consent to the use of overhead wires for the purpose of supplying current to the parish of St. Margaret's-at-Cliffe.

Darlington.—The T.C. has applied for a loan of £3,220 for the installation of a new generating set.

An agreement has been entered into for the supply of current to the extensive works of the Cleveland Bridge and Engineering Co., Ltd.

East Ham.—With regard to abstract of accounts of the electricity and tramways undertakings for the year 1910-11, the Electricity Committee has decided to carry forward the deficiency of the tramways fund revenue account to the current year, and to apply the credit balance of the electricity fund revenue account to writing off capital in respect of amounts deducted from borrowing powers by the Local Government Board. It has further decided to reduce the price of current supplied to the tramways undertaking for traction from 1·25d. to 1·125d. per unit.

Fareham.—The U.D.C. has decided to give a whole-day supply of current for the benefit of those needing energy for motors and radiators. This will entail an additional cost of £150 per annum, but it is considered that this will be ultimately met by the increased use of current.

Grays.—The U.D.C. has decided, in order to encourage the more extensive use of arc lamps for the outside of business premises, to reduce the charge for current for outside lamps, to 3d. per unit.

Great Harwood.—In connection with the scheme prepared by Mr. Speight for providing the district with electric light, a sub-committee of the U.D.C. has been authorised to visit Penrith to inspect a similar scheme in operation there.

Greenock.—Many of the leading manufacturers and contractors in the county have promised their support to the electrical exhibition being promoted by the Corporation, and to take place in the last week of this month. A special scheme of decorative illumination has been arranged.

Hessle.—Arrangements have been made by the U.D.C. to obtain current in bulk from Hull T.C., who will give the supply at the rate of 70,000 units at 2d. per unit, and 100,000 units at 1¼d. The agreement is for ten years.

Holmfirth (Yorkshire).—The U.D.C. has taken a poll of the ratepayers respecting the project for a public installation of electric lighting. The result was declared on Monday as follows:—For electricity, 1,276; against 580; neutral 204.

India.—At a recent meeting of the board of the Tata Hydro-Electric Power Works, applications were considered and accepted up to a total of approximately 34,000 H.P., which amount practically reaches the limit of the resources of the scheme in hand. Lists are now being made by the company for the purpose of ascertaining the exact requirements of several mills which have applied, and no further applications will be considered until these tests are completed.—*Indian and Eastern Engineer.*

Johnstone.—Another step in the movement to introduce electricity was taken by the Corporation last week, when a meeting was held with the representatives of the various industries in the town. The conference, which was of a cordial nature, was adjourned in order that more information might be obtained.

Lewes.—The T.C. has, by 14 votes to 7, decided to adopt electricity for public lighting, and to accept the tender of the Electric Supply Co. at £390, an average cost of £3 1s. 5d. per lamp. The gas company tendered at £448, the average per lamp being £3 10s. 6d.

London.—Fulham.—Additional coal storage is to be constructed at the Electricity Works at an estimated cost of about £70, by the provision of a new bunker with a capacity of approximately 1,000 tons.

Stepney.—The Finance Committee has considered a letter from the Electricity Committee stating that the £500 already advanced to supply consumers with apparatus and fittings on the hire-purchase system had nearly been expended, and asking for a further £500. It has been decided to approve an estimate for the amount. A further letter was received stating that the Committee was desirous of borrowing a further sum of £2,500 for defraying the cost of meters. This is also to be granted. Mains are to be extended in four streets. The Electricity Supply Committee has accepted the tender of Edward Wood & Co., Ltd., at £311 for replacing with steel plates the concrete slabs in three of the coal bunkers at the Limehouse electricity station.

Hammersmith.—The Council last week had before it a recommendation of the Electricity Committee (sitting on September 29th) that the expenditure of £45 on tickets for the Olympia Exhibition be approved. The Committee also expressed the opinion that the Fair Wages Clauses suggested by the L.G.B. were clearer and more comprehensive than the clauses usually inserted in the Council's contracts, and recommended their adoption in substitution therefor.

St. Pancras.—The Parliamentary and General Purposes Committee reports having had under consideration a communication from the clerk to the Clerkenwell Police Court, stating that an application has been made to the Magistrate, by a firm of electrical engineers in the borough, to appoint an Electrical Inspector under the provisions of Sec. 28 of the St. Pancras (Middlesex) Electric Lighting Order, 1883. This firm had objected to the Council's requirements in respect of fuses, as specified in the conditions which have to be agreed to by consumers when taking a supply. After careful consideration, the Committee decided to give instructions to its legal representatives to attend the Court on the day fixed for the hearing of the case, and should the Magistrate think it necessary to appoint an Electrical Inspector, to urge that he should be appointed for the purposes only of the application at present before him. The Electricity and Public Lighting Committee has under consideration a letter from Messrs. Marryat and Place, offering a tender of £1,000 per annum for the use of lamp-posts in the borough for advertising purposes.

Southwark.—The Electric Lighting Committee has had under consideration a report from the electrical engineer on the question of the hiring out of motors to customers. This system, he states, appeared to appeal to a large number of consumers, and there was every probability of the system being largely extended in the future. At the present time it was the practice of the Council to depreciate arc lamps and other apparatus on the basis of a life of five years, which worked satisfactorily for such apparatus, as fittings, lamps, radiators, &c., were always being superseded by improved apparatus. But with regard to motors the case was different, the useful life being not less than 15 years, and it was not possible to obtain for hire from the consumer a sum sufficient to cover depreciation and maintenance at that rate, so that with every probability of the hire system increasing, there would be a serious deficit to be met on the hire account for at least five years unless the period was extended. The usual rate for hire was 10 to 12½ per cent. on the cost of the motor, and the engineer suggested that the cost should be written off in 10 years, which in consideration of the fairly high residual value would leave a margin each year to cover repairs and make the scheme self-supporting, thus avoiding the necessity for making a charge on revenue account. After fully considering the views of the engineer, the Committee decided to extend the time from 5 to 10 years.

Moseley.—The Birmingham T.C., which is about to supply current at Moseley, has opened a showroom for electrical fittings and appliances in Alcester Road.

North Berwick.—In connection with the proposed electric lighting installation for the town, a communication has been received by the Council from Messrs. Crompton & Co. to the effect that they are unable to accept the gasworks site for the proposed electricity works. The cost involved in the laying of cables from a site so far out of the town would, in their opinion, be prohibitive.

Romford.—The Electrical and Engineering Supplies Co., Ltd., are about to extend their mains to Harold Wood, and have applied to the R.D.C. for permission to open the roads and footpaths for this purpose.

At the last meeting of the Board of Guardians it was decided to obtain particulars from other unions as to the estimated cost of electric lighting.

St. Helens.—The B. of T. has consented to the T.C. using overhead lines for the purpose of supplying electricity to the Sutton Moss Peat Works, at a pressure of 400 volts.

The T.C. has received the sanction of the L.G.B. to a loan of £10,800 for extensions to the electricity works.

Salford.—The T.C. has appointed Mr. C. D. Taite to report upon a proposal to install an additional turbo-generator at the electricity works, and also in regard to other matters in connection with the plant thereat, at a fee of 50 guineas.

Sheffield.—It is proposed that the chief officials of the electric light and tramways departments should be instructed to report to their respective Committees on the advisability of arranging for the mutual transference of electrical energy between Neepsend power station and the Kelham Island power station of the city tramways in case of necessity, with an estimate of the approximate cost.

Stafford.—The T.C. has decided that the present system of gas lighting in the main streets be abolished, and that in future the lighting be by electricity, the annual charge for the latter being £267, or £6 less than the charge for the present mixed lighting.

Tiverton.—At a meeting of the T.C. on Monday, a letter was read from Dr. Purves, of Exeter, who some time ago notified that he was applying for an electric lighting provisional order. He suggested that, as the Council owned the gas undertaking in Tiverton, the following plan might be adopted: That the Council grant him permission to erect, at his own cost, an electric generating station, on a site to be approved by the Council, and a refuse destructor; and to operate and work that combined undertaking with the object of supplying electricity in bulk to the Corporation at, say, 3d. per unit, with a guaranteed minimum payment of, say, £750 per annum, and that for all electricity consumed in excess of that the charge be reduced to 2½d. per unit The letter was referred to the Lighting Committee.

Torquay.—The Council has received an intimation from the overseers to the effect that they propose to increase the gross assessment of the electricity works from £300 to £450.

Walsall.—There have been several complaints recently respecting the failure of the electric light and traction supply, and the Corporation Electricity Committee has, therefore, felt it necessary to issue an explanation in which it states that it is working under great disadvantages, owing to the alterations and extensions now in progress at the generating station during the reconstruction of part of the works.

Wath.—The U.D.C. has decided to oppose the application of the Yorkshire Electric Supply Co. for a prov. order for electricity supply.

Wimbledon.—With regard to the proposed purchase from the Polytechnic Estate, Ltd., of a plot of freehold land with buildings thereon, as a site for an electric transformer sub-station, and the electric mains on the estate, the offer has now been withdrawn. The borough electrical engineer reports that in connection with the supply of electricity to Maldens and Coombe, it will be necessary to erect an electric transformer sub-station in the parish of Coombe, and that the Maldens and Coombe U.D.C. has offered to lease a site for a term of 18 years; the T.C. has agreed to this.

Worthing.—A statement as to the financial position of the Corporation electricity undertaking was made to the T.C. on Friday last by the chairman of the Finance Committee, when introducing the estimates for the coming half-year. Dealing with the electricity revenue account, the Alderman pointed out that the net result of the trading for the past half-year was that they were £95 better off than they expected to be, and it was anticipated that they would next March show a credit balance of about £395.

TRAMWAY and RAILWAY NOTES.

Argentina.—Although, owing to lack of capital and the difficulties of transport, the mining industry is only in a latent condition in Argentina, this state of things will, according to the Belgian Consul at Mendouza, tend to disappear when the concession to utilise the falls of Ninil, on the River Atuel, is carried out. It is intended to appropriate some 40,000 H.P. for the working of railways

in the Department of San Rafael, in the southern portion of the province, a region containing some extremely rich belts of ore. The concession is now under the consideration of the Governor of the province.—*Revue Pratique de l'Electricité.*

Australia.—The Launceston (Tasmania) municipal tramway system was formally opened for traffic on August 16th. The total length of track is about 5¾ miles, with a total length of line of 7 miles. The line is 3 ft. 6 in. gauge, laid on Tasmanian hardwood sleepers and macadam roadway, the rails are 90 lb., with 96-lb. rails at curves; the shortest radius of curve is 52 ft. The equipment consists of ten motor-cars and four trailers, the cars having an enclosed compartment in the centre and an open section at each end. Power is taken from the Council's three-phase system to a sub-station in Cameron Street.

The B. of T. has received copies of reports of the Victorian Parliamentary Standing Committee on Railways, recommending the execution of certain works. The Committee further points out the advantages of the electrification of the suburban railways of Melbourne, at a total cost for the 218 miles of £2,227,050; and states that, should the electrification of the Caulfield and Camberwell lines not be sanctioned by Parliament early in 1912, it will be necessary to duplicate those lines, at a cost, including regrading, of £964,000.

Bradford.—The Corporation Tramways Committee has considered the report of the general manager on the question of the extension of the railless trolley system, and has decided to recommend the City Council to include in its application to the B. of T. for a prov. order authorising the Corporation to use trolley vehicles on certain routes within the city, three additional routes.

The general manager has reported to a sub-Committee upon the subject of fixing shock absorbers on the railless trolley cars on the Dudley Hill section, and has been authorised to have the work carried out on approval, one car to be fitted with lever springs and the other with hydraulic buffers.

Brazil.—A contract has been made between the Government of the State of Alagoas and a Maceio company for the installation of sewerage, water-supply and electric traction systems in that town. Work is to be begun within 12 months from October 22nd.

Burnley.—On October 4th, two Corporation employés were at work on the overhead tramway wires when the "tower wagon" dropped on its side. The men on the wagon saved themselves by hanging on to one of the overhead wires. A police constable released them from their predicament, throwing a rope by which they were enabled to descend. The shafts of the wagon were broken.

Continental Notes.—Portugal.—The Companhia Carris de Ferro do Porto has applied for a concession for the construction of an electric railway from a point on the Paranhos line to the works of the Portuguese Sugar Refining Co.—*Board of Trade Journal.*

Italy.—The Government has decided to entrust to private contractors the construction of the new electric railway from Naples to Atripalda. The line will have a length of 55 km., and will open up a rich agricultural district having a population of 100,000.

France.—The historically interesting portion of Normandy, embracing Caen, Honfleur and Falaise and some 20 towns in the neighbourhood, is about to be served by an electric tramway to run from Potigny to Mezidon. The district has considerable industrial interest, and the local Chambers of Commerce are strongly in favour of the scheme. The official inquiry will take place towards the end of the month.

Germany.—A treaty is in course of arrangement between Hamburg and Prussia, which will allow of the advantageous development of the electric railway systems of these two important sections of the German Empire. Prussia accords its consent to Hamburg extending its railway to the villages of Farmsen, Volksdorf, Wohldorf and Gross Hansdorf through Prussian territory. The cost of this railway, which the citizens have yet to ratify, is estimated at 9,000,000 M. On the other hand, Hamburg gives its assent to the extension by Prussia of the Blankensee-Ohlsdorf Railway, the first full-gauge electric railway to run in Germany. Prussia has two objects in this extension; it will be able to open up communication with the townships in the Alster Valley and, later, an extension to Segeberg will be made, in order to secure control over the heavy goods traffic from the North-East to Hamburg without the participation of the Lübeck-Büchen Railway. An ultimate object is the cheap acquisition of the last named, a prosperous private undertaking whose shares were recently quoted 184¾, with a dividend of 8½ per cent.

The project of an electric tramway at Wilhelmshaven, in Hanover, was recently brought to a standstill by an interdict lodged at the instance of the Kaiserlichen Observatorium. The dispute has now been settled by the payment of a sum of 30,000 M. as compensation. In consequence, the scheme will now be proceeded with.

Switzerland.—With regard to the special form of electric traction to be adopted on Swiss Federal railways, the Commission nominated to study the question has decided in its report to recommend the adoption of single-phase current at 15,000 volts. The Commission acknowledges that traction by continuous current conduces to a lower consumption of current, but this advantage is offset by various inconveniences, and in particular by an increase in the first cost. Transformation would cost about 70,000,000 fr.; the economies realised on working expenses would be about 10 per cent. The Federal Budget has already anticipated credits for the purchase during the present year (1911) of a certain number of waterfalls, to be utilised to supply electricity to the railways.—*La Revue Electrique*

Hungary.—Plans are being prepared in respect of a projected electric railway between Budapest and Budakesz.

Darlington.—At a meeting of the T.C. on the 5th inst., a report was submitted from the Electricity and Light Railways Committee on the use of railless trolley cars and motor-omnibuses. Mr. Lunn (the engineer) explained that he had visited Leeds and Bradford, where railless cars were in use, and found that they gave no trouble, and the Corporation was well satisfied with them. The cost of cars similar in size to those in use in Darlington, was £700 approximately, and the overhead equipment cost from £1,200 to £1,500 per mile. The cost of running the cars on a 10 minutes' service was about 7d. per mile, including interest and depreciation, but not the repayment of the expense of obtaining Parliamentary powers. Motor-omnibuses cost from 9d. to 10d. per mile, or 1s. including capital charges. If a service was to be run in the Greenbank and Hopetown districts, he recommended the railless system as the cheapest and most reliable, but thought there was not sufficient traffic along these routes to make the service pay. He also thought that they could not expect to earn 7d. per mile on the Victoria Road route. Mr. Bates, a member of the Tramways Committee, said probably they would soon have something further to go upon. The report was adopted, an amendment by Mr. Gregg that the report be taken back for a reconsideration of a proposal to extend the system, being defeated.

Dundee.—The Trades Council seems determined to keep alive the agitation against the withdrawal of the workmen's cars and the reduction of the ½d. stages. At its last meeting the matter was again raised, and strong dissatisfaction expressed at the Tramway Committee's action. The members unanimously agreed to hold an indignation meeting to protest against a continuance of the scheme.

Edinburgh.—In connection with the proposal to adopt the railless traction system, members of the Corporation Tramways Committee recently visited a Princes Street picture house and had a private view of moving pictures, showing the running of railless cars in the towns visited by a recent deputation. The Committee afterwards went over certain routes which it is suggested might be equipped for the new system. If thought advisable, a provisional order to enable the system to be adopted may be applied for during the ensuing session of Parliament.

Halifax.—The Corporation Tramways Committee has decided to ask the T.C. to double the tramway lines on various routes where there is at present only a single track. An expenditure of about £10,000 will be involved.

Haslingden.—The Accrington Corporation Tramways Committee has requested the Haslingden T.C. to take in consideration the installation of automatic signalling arrangements on its tramways. The question has been left in the hands of the chairman, vice-chairman, and the engineer.

Heston and Isleworth.—The chief engineer of the electricity department reported at the last meeting of the Council that experiments were being tried in lighting the High Street with Jandus arc lamps.

Hull.—The assessment of the Corporation tramways has been reduced from £13,753 to £11,500.

Powers are to be sought to extend the tramways down Cleveland Street and Stoneferry Road to Stoneferry.

Ilford.—The question of extending the tramways down Cranbrook Road by either an extension of the present system or a railless system is under consideration.

Japan.—The T.C. of Tokio has received the Government's sanction for the establishment of electric tramways. Five new lines are to be laid, and some 500 new second-class cars acquired, as also open cars for the carriage of workpeople.—*Elektrotechnik und Maschinenbau.*

Leeds.—The tramways have had a most successful half-year. No fewer than 43,466,288 passengers were carried in the period, so that estimating the population at half a million, the population was carried over 87 times. The number was 2,911,011 more than in the corresponding period of the previous year, or an increase of 7·18 per cent. The receipts were proportionately higher, representing an increase of £15,237.

Liverpool.—The question of applying to the Tramways Committee to place first-class cars on the Stanley Road route, which is the only route on which they are not running, was raised at the meeting of the Bootle T.C. on Wednesday, October 4th. Councillor Watson thought a more important matter was the necessity of a better third-class service, especially at night time. After further discussion, Alderman McMurray protested that this was no laughing matter. When first-class cars were introduced in Liverpool, the new departure was treated with levity and sneers, but this service had proved a great success, and if the committee was willing to entertain this suggestion, he did not see why a month's trial should not be given. No resolution was submitted.

London.—In connection with the Earl's Court Station of the District and Great Northern and Piccadilly Railways, an escalator or moving staircase has now been put to work; similar methods are proposed for connecting the Charing Cross District Railway station and the new tube station which is to be constructed beneath it; also for connecting Paddington Station with Edgware Road Station, and the new tube station which is to be built under Paddington.

Nelson.—At the T.C. on October 5th, a letter was read from the Colne and Trawden Co. suggesting a conference of representatives of the Burnley and Nelson Tramway Committees and the company as to through running over the three systems. The Nelson Tramways Sub-Committee had met Mr. M. Turner, manager of the Colne and Trawden Co., respecting the provision of additional covered cars, and two are to be obtained.

St. Helens.—The T.C. has appointed a Special Committee of nine members with a view to ascertaining the exact position of affairs between the St. Helens Tramways Co. and the Corporation, and to inquire into all transactions, leases and agreements concerning the same, and to report thereon to the Council. Mr. Grace, who moved the resolution at the Council meeting on Wednesday, October 4th, alleged that the tramway company had treated the Corporation contemptuously in the matter of fares and other things, and it was an injustice to the ordinary consumers and ratepayers that the company got a great advantage in the supply of electricity from the Corporation. After criticising the car service and the condition of the cars, and the track, he argued that if the company said it could not make money on the present basis, the time had arrived for it to say so, and to ask that the Corporation should take the concern over. Alderman Forster pointed out that the Corporation was the owner of the tramway system, and leased certain powers to the tramway company. He admitted that its relations with the tramway company were not so cordial as they might be.

A Sub-Committee has been appointed by the Corporation to consider and report upon the railless trolley system.

Rotherham.—The Corporation Act, 1911, authorised the Council, among other things, to extend the Wellgate tramway along Broom Road and Wickersley Road to the borough boundary at Herringthorpe Lane; to extend the Dalton tramway along Doncaster Road to Thryburgh; and to run a trolley vehicle route from the borough boundary on the Wickersley Road to Maltby. With regard to the former, the Electric Lighting and Tramways Committee has decided to proceed with the work forthwith, and has instructed the borough engineer to prepare the necessary plans and specifications, and to invite tenders for the rails and other materials required. With regard to the trolley vehicle route, application is to be made to the B. of T. for permission to commence the construction thereof before January 1st, 1912. The borough engineer, in conjunction with the tramways manager, is to prepare plans for an extension of the tramways depôt.

Walsall.—The Tramways Committee of the Corporation is purchasing St. Paul's Buildings on the bridge for the sum of £2,150, with the intention of adapting them for the purposes of cash and other offices.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Postmaster-General last month accepted the tender of the Automatic Electric Co., of Chicago and Sydney, for an automatic switchboard for the new Geelong telephone exchange, costing £14,293. The lowest tender for a manual board was £7,773.—*Australian Mining Standard.*

Hythe.—A dispute has been in progress for 12 months between the National Telephone Co. and the Town Council of Hythe, the latter having called upon the company to remove a number of poles which carry 64 lines along the bank of the military canal, through a part of the town considered exceptionally beautiful. As no alternative route could be found, the company was unable to accede to the request, but last month the T.C. gave the company 14 days' notice to remove the poles. The company then informed the local subscribers that the telephone service would be discontinued on Wednesday this week. However, the Council was unable to withstand the protests of the townsmen, and a temporary truce has been established, during which the Post Office will be approached to ascertain whether, on taking over the company's business, the former will place the wires underground, or whether it will insist on replacing the poles.

London.—Southwark.—On Monday last Mr. Hopkins, as arbitrator between the Postmaster-General and the Southwark B.C., in a dispute concerning the erection of overhead wires along certain streets for fire alarm signals, gave his decision in favour of the Post Office, stating that he could discover no reason for apprehending danger, disfigurement or inconvenience from the use of overhead wires.

The P.M.G.'s Report.—The fifty-seventh report of the Postmaster-General on the Post Office Dept. for the year to March 31st last has been presented. Although there were 634,000 inland telegrams less than in 1909-10, the foreign messages increased by 419,000, leaving a loss of only 0·2 per cent. on the total number of messages dealt with. The receipts show an increase of £4,213 on a total of £2,773,266, a result which can hardly be considered satisfactory. During the year under review 160 new post offices have been opened, but only at 999 out of a total number of 11,451 offices open for the receipt of telegrams, is the business carried on under guarantee.

High-speed telegraphy and other improvements have been developed, and an attempt has been made to effect delivery of telegrams by telephone in order to economise in messenger service.

With regard to the foreign telegraph service, the agreements between the Atlantic Cable Companies, by means of which the British Companies are practically absorbed by the American Company, are vaguely referred to as conferring "an improvement of the facilities for sending telegrams to and from North America," and it is stated that "a measure of Government control over the rates charged by the companies for telegrams between the United Kingdom and North America will be secured through the licenses to land cables in this country which are about to be issued."

Plain language in foreign telegrams at half rates is stated to have been accepted by the British and American Cable Companies, but we do not quite agree that the conditions of the acceptances have been settled or can be settled until the question of the 24 hours' deferment of transmission has been determined, as well as other material questions for consideration, such as the transmission of dates, code times, &c., necessary to distinguish these telegrams. It is an easy matter to devise schemes such as the above, but to be useful they should be general, not partial, in effect, and should be put into force after proper discussion and agreement on European lines as well as on the extra-European systems. The question of examination of codes might very well be settled by charging at a letter rate, thus disposing of what appears likely to become an everlasting question.

Wireless telegraphy is moving, as it should do, but there does not appear to be a separate account showing the cost of erection, and this is very material when expansion of business and revenue is considered. £16,000 is now to be spent on reorganisation. The telegraph deficiency account is a serious one, and seems to be increasing annually. It is stated at £1,182,321, and a footnote calls attention to this being overstated by the telephone proportion of the cost of new mixed works charged temporarily to the telegraph service extensions, but the amount is not given or estimated.

The telephone revenue was £1,938,330, an increase of £233,764, and the expenditure £1,980,160, an increase of £192,531. The net deficit, therefore, was £41,830, about half as much as last year.

The number of wireless telegrams handled by the coast stations of the Post Office was 5,640 outward to ships, compared with 3,266 in the previous year, and 34,161 inward, compared with 27,727; the total increase was 8,808, or 28·4 per cent. The revenue was £7,941. There were 290 British ships equipped with wireless telegraph apparatus, compared with 130 in the previous year—a very large increase.

The report on the P.O. telephone service shows that there were 678 trunk exchanges open, an increase of 35, and 2,848 trunk circuits, an increase of 182. The capital expended on this branch amounted to £5,337,725, an increase of £283,153, and the conversations over inland trunk lines numbered 30,100,068, an increase of 13 per cent. The revenue was £765,282, an increase of 15 per cent. The receipts from Continental calls amounted to £24,666, an increase of £531.

New Post Office telephone exchanges to the number of 137 were opened in the provinces, mainly in less populous parts where they produce no profit, but sometimes a loss. The total number of lines connected with the Post Office exchanges was 28,441, compared with 26,112; and the number of exchange telephones was 36,650, compared with 33,330. In London the Post Office subscribers numbered 73,305, as against 64,200. The number of calls was about 85½ millions, compared with 70 millions. The telephone was used to forward 5,372,000 telegrams last year, an increase of 9·1 per cent., and 196,000 express letters, an increase of 20 per cent.

Wireless Telegraphy in Ceylon.—Messrs. Marconi's Wireless Telegraph Co., Ltd., has entered into a contract with the Crown Agents for the Colonies for the establishment of a radio-telegraph station in Ceylon, capable normally of sending a wave 600 metres in length. In addition, however, with any wave between 1,000 and 2,000 metres, the station will maintain communication with any ship off Madras, or with any ship up to a distance of 450 miles over sea (except during periods of severe atmospheric disturbances), provided the ship is fitted with an aerial having a mean height of not less than 100 ft., and suitable receiving apparatus. The generator will consist of a 10-H.P. motor, taking power at 100 volts, 60 cycles, from mains direct coupled to a 5-KW. alternator and exciter. The discharger will be of the disk type direct coupled to the motor-alternator, and designed to produce a musical spark. The receiving apparatus will consist of a magnetic detector in combination with a multiple tuner, which will be constructed to provide a highly syntonised circuit for all waves between 100 and 2,500 metres, and a receiver of the valve type, which will be used in place of the magnetic detector in reception from 1,600 to 4,000 metres. Two masts will be provided, each 270 ft. in height overall.—*The Marconigraph.*

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—October 28th. Gas-raising and by-product recovery plant, one 1000-H.P. gas engine, and one 750-KW. E.H.T generator, for the Corporation. See "Official Notices" to-day.

Algeria.—October 24th. The Algerian Post and Telegraph authorities in Algiers are inviting tenders for a quantity of bronze wire and lead and rubber-covered cables.

Australia.—Western Australia.—November 21st. One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th.

South Australia.—November 1st. 5,000 insulators, porcelain No. 8, for the P.M.G.'s Department. See "Official Notices" September 22nd.

November 29th.—One portable hand-driven desiccating plant, and binders, sleeves, tapes and copper wire, for the P.M.G.'s Department. See "Official Notices" to-day.

New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

November 15th.—Telephone cords and ear-pieces, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 15th.—Magneto switchboards, &c., for the P.M.G. See "Official Notices" October 6th.

Queensland.—November 8th. Ironwork, measuring instruments and protectors, switchboards, switchboard parts and accessories, telegraph and telephone instruments, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 22nd.—Cable for the P.M.G.'s Department. See "Official Notices" September 29th.

Victoria.—November 28th. Ebonite earpieces, calculagraphs, and insulators for the P.M.G. See "Official Notices" October 6th.

Belgium.—The municipal authorities of St. Chislain (Hainaut) are about to invite tenders for the establishment of a small electric lighting and power plant at the Ecole des Arts et Metiers in that town. The plant will comprise a 40—50-H.P. gas engine, a dynamo, three small dynamos, a battery of accumulators, and the necessary material for an installation of 250 lamps.

Canada.—Lethbridge.—November 24th. Municipality. Power station equipment comprising boilers, economiser, steam turbo-generator, condenser and sub-station equipment; 10 per cent. deposit with tender. Plans, &c., from A. Reid, superintendent engineer, Lethbridge.

Dublin.—November 6th. General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" to-day.

Great Western Railway.—October 16th and November 7th. Stores for a year. See "Official Notices" October 6th.

Grimsby.—October 16th. Paper-insulated lead-covered cables, house fuse boxes, and mains service boxes for the Corporation. See "Official Notices" September 29th.

Hastings.—October 18th. Electric lighting of the workhouse, Ore, for the B.G. See "Official Notices" September 15th.

Italy.—Rome.—October 30th. Open to foreign competition, 10 per cent. deposit with tender. Lamps and lamp fittings for electric light installations, about £8,000. Particulars from Direzione Generale dei Servizi Amministrativi, Ministero della Marina, Rome.—*Board of Trade Journal.*

London.—L.C.C.—October 24th. Sub-station plant and machinery. See "Official Notices" September 15th.

Newcastle-on-Tyne.—October 24th. (*a*) Tramway rails, and (*b*) tie bars, for the T.C. City Engineer (returnable deposit £1 1s.).

Rotherham.—The borough engineer is to prepare plans in connection with the extension of the tramways to Thrybergh and to the borough boundary. Tenders are to be invited for the rails and other materials required.

Sheffield.—November 13th. One 5,500-KW. steam turbine, condensing plant, pumps, pipework, &c., and alternator and exciter, for the Corporation. See "Official Notices" to-day.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

South Africa.—November 22nd. Posts and Telegraph Department. Tenders for power-generating plant, consisting of motor-generator, accumulators, switchboard, &c. Forms of tender and specifications from either District Stores Clerk, G.P.O., Johannesburg, or Controller of Stores, G.P.O., Capetown.

Spain.—The municipal authorities of Caudiel (province of Castellon) have recently invited tenders for the concession for the electric lighting of the town during a period of eight years.

Tenders have lately been invited by the municipal authorities of La Mata (province of Toledo) for the concession for the electric lighting of the town during a period of five years.

Swansea.—October 16th. Electrical installation at the cattle market and slaughter house, for the T.C. C. A. L. Prussmann, borough electrical engineer, Strand (returnable deposit, £1 1s.).

Taunton.—200-K.V.A. single-phase alternator, superheater, cables, and induced-draught fans for the Council. See "Official Notices" October 6th.

Truro.—October 21st. Installation of private internal telephone system, at the new offices, for Cornwall C.C. Clerk of the Works.

Warrington.—October 20th. Electric lighting of Evelyn Street Council School. Specification and forms of tender obtainable from Mr. F. V. L. Mathias, electrical engineer, Electricity Department.

CLOSED.

Belgium.—La Société d'Electricité du Borinage submitted the only tender that conformed to the conditions for the concession for the supply of electrical energy for lighting and power purposes in the town of Mons.

Blackburn.—The T.C. on October 4th accepted the tender of Mr. Frank L. Yates for the electric lighting of the sub-police station.

Bradford.—The Technical College Committee of the Corporation has been recommended to accept the following tenders:—

Six electric motors.—Phœnix Dynamo Manufacturing Co., Ltd., £380.
Eighteen alternating motors.—Siemens Bros. Dynamo Works, Ltd., £330.

The Tramways Committee has accepted the offer of the Jandus Arc Lamp & Electric Co., Ltd., to supply "Jandus" electric arc lamps and other fittings for lighting the new car depôt at Bankfoot, for £111.

Chesterfield.—The Electric Energy Committee of the T.C. has accepted the tender of Mr. H. Furness for slack coal, 2,000 tons of Glapwell at 4s. 1d. per ton, 3,000 tons of Hardwick at 4s. 3d., and 200 tons of Langwith at 4s. 10d.

London.—The contracts for the electric lighting of the following mills have been placed with Messrs. G. Weston & Sons, Ltd.:—The Hovis Bread Flour Co., Ltd.; Messrs. Peek Bros. and Winch, Deptford; Messrs. A. Lloyd & Son, Ltd., Deptford.

Messrs. Willans & Robinson, Ltd., have received an order from Messrs. D. Napier & Son, Ltd., for a Willans-Diesel oil engine to drive a 200-KW. direct-current dynamo, for installation at their works at Acton Vale, London, W.

Bermondsey.—The tender of Messrs. S. Pontifex & Co. has been accepted, at £48, for the supply of 50 16-in. electric street lamps and frog-irons.

Islington.—The Guardians have accepted an offer from the Tudor Accumulator Co., Ltd., at £98, for replacing the plates on the electric battery at the Highgate Hill Infirmary.

Southwark.—The B.C. has accepted the tenders of the British Insulated and Helsby Cables, Ltd., at (1) £232, for the supply of 440 yards of .3 low-tension triple-concentric cable, and at (2) £40 for an 8-way feeder pillar.

Woolwich.—The T.C. has accepted the tender of Messrs. W. Cory and Sons for 10,000 tons of coal, at 8s. 7d. per ton, for the electricity works.

Messrs. Pope's Electric Lamp Co., Ltd., have secured a portion of H.M. Office of Works' contract for metal-filament lamps.

Rotherham.—The T.C. has accepted the following tenders:—

Callender's Cable and Construction Co., Ltd.—The annual supply of vulcanised bitumen cable, at £914.
Ferranti, Ltd.—Electricity meters for the ensuing year.
W. A. Durnford (Earl Fitzwilliam's Colliery).—Coal at 6s. 8d. per ton.
Sheepbridge Coal and Iron Co., Ltd.—Coal at 5s. 4½d. per ton.
British Westinghouse Co.—Armature coils (DK 25a).
Dick, Kerr & Co.—Armature coils (DK 9).
Anti-Attrition Metal Co.—Armature brasses and axle brass keeps.
British Westinghouse Co.—Okonite tape, gear wheels.
L. Andrews & Co.—Tape.
National Rail and Tramway Appliance Co.—Brake blocks.
Imeson, Finch & Co.—Trolley heads, cheeks, and harps and controller fingers.
Brecknell, Munro & Rogers.—Trolley bushes.
M. Bonser & Co.—Trolley spindles, washers and binding wire.
Le Carbone.—Carbon brushes.
W. E. Burnand & Co.—Presspahn paper.
A. Wiseman, Ltd.—Pinion wheels.
The Tenter Foundry Co.—Brake castings, &c.
The Weldless Chains, Ltd.—Brake chains.

The tender of Messrs. Renton, Holdsworth & Co., Ltd., at £92, has been accepted for completing the electric wiring at the South Grove Higher Standard School in lieu of that of Messrs. Hall & Matthews.

Stoke-on-Trent.—The following tenders for the electricity works have been accepted by the T.C.:—

Sneyd Collieries, Ltd.—Cockshead beans to Burslem Works, 7s. 9d. per ton
Bakewell & Butterworth.—Great Row slack to Hanley Works, 8s. per ton.
Mossfield Colliery, Ltd.—Engine slack to Longton Works, 6s. 9d. per ton.
Heenan & Froude, Manchester.—Ironwork for power house, £900.

Swinton and Pendlebury.—The tender of Messrs. Halliwell, of Manchester, at £132, for electric wiring and fittings at the new Council School has been accepted by the Education Committee.

Watford.—The U.D.C. has decided to obtain tenders for a 12 months' supply of transformers. The tender of the Clay Cross Co. has been accepted, at £67, for the supply of a new suction pipe for the turbo-condenser.

West Ham.—The T.C. has accepted the tender of Messrs. Strachan & Henshaw, at £4,398, for the supply of coal-handling and discharging plant at the electricity station.

Wigan.—The T.C. has accepted the tender of the Rees Roturbo Co., Ltd., at £261, for two electrically-driven centrifugal pumps, with valves and regulating gear, for the water department. It has further accepted the tender of Messrs. Ormandy, Spensley and Co., at £550, for steam plant, including three Lancashire boilers, economisers, pipes and fittings, for the Pemberton electricity station.

(*Continued on page* 622)

SUPPLEMENT.

SOME OF THE EXHIBITS AT OLYMPIA.—IV.

(The figures in parentheses are the numbers of the stands.)

Walker, Horrocks & Co., Ltd. (231),
45, *Newhall Street, Birmingham.*

This firm's exhibit consists of two automatic electric lighting plants, suitable for private installations in country houses, farms, yachts, &c.

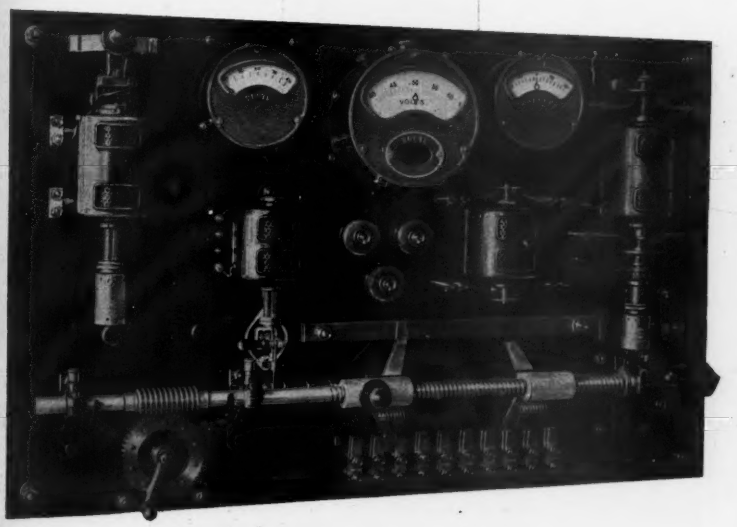


Fig. 162.—Automatic Control Board.

Our readers are familiar with the general idea of such plants, which consist briefly of an engine, dynamo and battery, together with an automatic switchgear which controls the discharging and charging of the battery. In this plant a fall in battery pressure to a specified limit causes the automatic regulator to add regulating cells, one at a time, until they are all in use, when it operates the solenoid control switch of an automatic starter and a magnetic petrol tap, enabling the battery (operating the dynamo as a motor) to start up the engine, and the latter in turn to generate current for recharging the battery.

As the charge proceeds the regulator cuts out cells, and finally, when the battery is fully charged, breaks the solenoid circuit of the starter and petrol tap and stops the engine. A reverse current time-element circuit-breaker is fitted to prevent the generating set from motoring, due to failure of fuel supply, &c., the time lag allowing for the normal starting-up of the engine. The operation of the breaker (which isolates the dynamo and prevents waste of battery current) is indicated by a red lamp fitted in a conspicuous position.

To prevent the regulating cells from being overcharged, the connections are such that when all of these are in the discharge circuit, they are all out of the charge. To meet a heavy temporary demand on the plant, by means of a maximum coil in the discharge-circuit or a switch coupled to the power-feeder switch, the engine may be started up irrespective of the battery.

On the firm's stand one small and one large plant are shown; the former (see fig. 163) is fitted with an ironclad controller, while the larger plant has a controller of the switchboard pattern, illustrated in fig. 162, in which, in addition to the usual instruments, the battery charge and discharge switch, time-element circuit-breaker and automatic starter can be seen.

We may add that the dynamos used are specially wound to give a constant output in watts at a voltage varying with the state of the battery, and the smaller sizes are fitted with ball bearings. The engines are direct-coupled to the dynamos, and are fitted with H.T. magneto ignitions.

The plants can be seen in operation, with both a lighting and a heating load connected; they are well finished and well worth inspection.

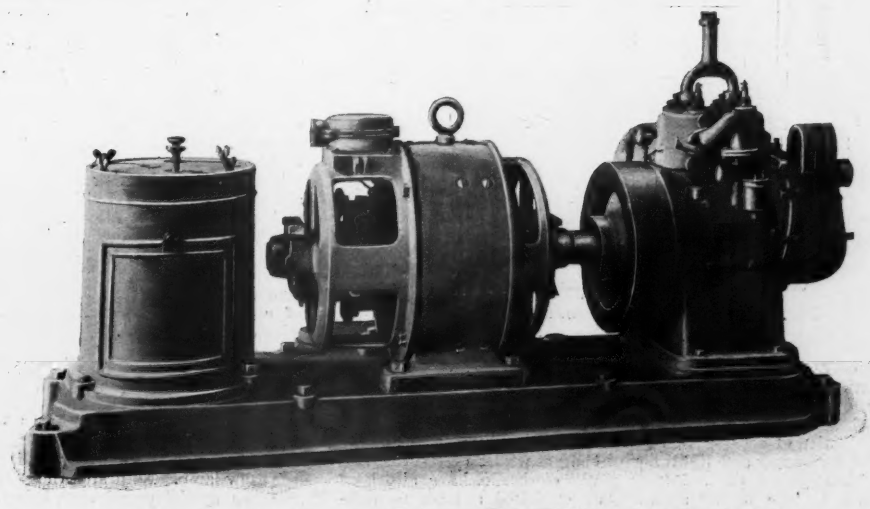


Fig. 163.—Automatic Electric Lighting Set, with Ironclad Controller.

Messrs. Isenthal & Co. (20, 41),
85, *Mortimer Street, W.*

This stands presents a striking appearance, owing to the batteries of condensers, line dischargers and other protective devices which form its most prominent features. The theory of surges in transmission lines and the practice of line protection are alike unfamiliar to the majority of British engineers, owing to the conditions which render the occurrence of surges comparatively infrequent in this country; nevertheless, as transmission lines develop in length and the current and pressures employed increase, these phenomena are

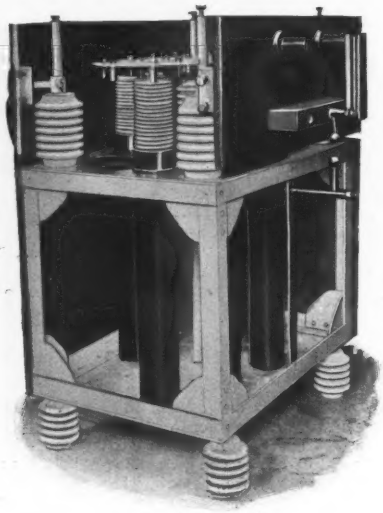


FIG. 164.—BATTERY OF CONDENSERS FOR WIRELESS TELEGRAPHY.

bound to make themselves unpleasantly felt, and already some of our larger systems have suffered severely from their consequences. In the British Colonies, however, and other parts of the world where high-pressure transmission over long distances has attained to greater dimensions, the importance of the subject has compelled attention, and the excellent system of protection introduced by Messrs. Isenthal & Co., who have specialised in this direction, has

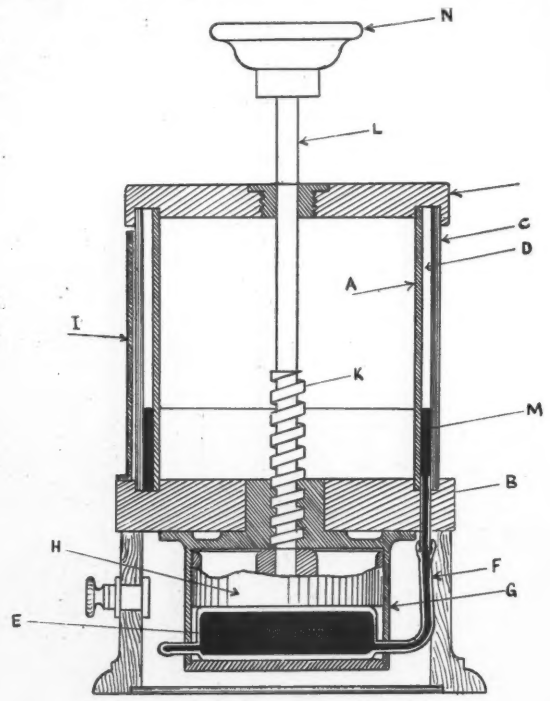


FIG. 165.—SECTION OF MERCURY CONDENSER.

been extensively adopted there. We have already described the ingenious Moscicki condensers, which are designed so as to possess large capacity jointly with great reliability, in small space; these have been further improved. The "Giles valves," which by a clever combination of spark-gaps, resistance and capacity provide an easy outlet for surges and lightning discharges whilst obstructing and quickly stopping the following power discharge, have also been described. The former apparatus are exhibited as made for pressures of 35,000 and 18,000 volts, and the latter for 9,000 and 12,000 volts, but the makers are able to supply them for any pressure used in practice. In this connection it is interesting to note that in Australia a pressure of 80,000 volts is being employed. Complete outfits, with iron choking coils and liquid disconnecting switches, are shown as fitted up in central stations.

Another purpose to which the Moscicki condensers have been very largely applied is that of wireless telegraphy. The compactness and reliability of the condensers renders them particularly suitable for this purpose, and large numbers have been supplied to the British Admiralty, War Office and Post Office, as well as to foreign Government departments and the Marconi Companies. These are made for 60,000 volts. We illustrate a battery, partly opened to show the interior, as supplied to a foreign Government (fig. 164). New types of insulators for the rigging of aerial masts and for antennæ are exhibited; these are exclusively used by the German Navy.

One of the most interesting novelties shown is a new variable condenser, which we illustrate (fig. 166). This is based on a novel principle, and combines very large capacity with simplicity and compactness. As shown in the cross-section, fig. 165, it consists of a metal cylinder A fixed to an ebonite base B, and covered with a thin sheet of mica, in contact with which is a layer of mercury M contained in the annular space between the mica and a glass cylinder C. The height of the layer of mercury is varied by squeezing a rubber bag E containing mercury, in communication with the annular space D through a tube F. For this purpose a

FIG. 166.—ISENTHAL VARIABLE CONDENSER.

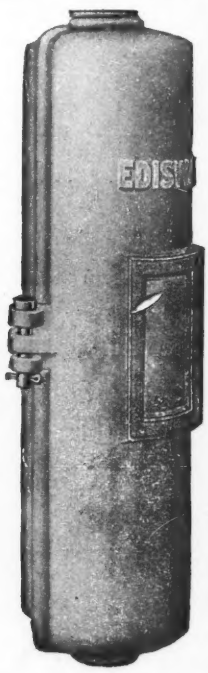


FIG. 167.—EDISWAN HOUSE SERVICE CUT-OUT.

piston H is pressed down in a cylinder G by the screw K L and handwheel N. The capacity is, of course, proportional to the area of the mercury surface and therefore to the height of the mercury, which is read off on an index I. It will be seen that there is nothing to go wrong in this device; it will not spark over, it remains at the value it is set for without locking, and the same capacity is contained in a volume less than one-fourth that of the usual type of variable air condensers.

Regulating resistances of the "Rheogot" type form another interesting feature of the exhibit. These are very neat variable resistances, made in various patterns, consisting of single or twin insulated metal tubes upon which wire is wound, contact with the wire being made by travelling brushes. A large demand has been experienced for these apparatus, which are applicable to a great variety of purposes.

The absence of cooking apparatus from the stand is noticeable, although at the 1905 Exhibition the "Elektra" cooking utensils took the first prize. Messrs. Isenthal are preparing to make these at their new Neasden works, whither their condenser manufacture, at present carried on in London, will shortly be removed. All their condensers, &c., are made at their London workshops, and the exhibit, it should be noted, consists entirely of apparatus taken out of stock, without special finish—though no one could find fault with their appearance.

Edison and Swan United Electric Light Co., Ltd.
(15, 16, 45, 46, 98, 117),
Ediswan Buildings, Queen Street, E.C.

This company has, on its two large stands, an exhibit worthy of its reputation and its long standing, dating from the invention of the glow lamp. Naturally the "Royal Ediswan" tungsten lamp is given special prominence, being shown in all sizes, from 1 to 1,000 C.P., and for voltages from 2 to 260 volts. A similar display

of the "Royal Ediswan" carbon-filament lamps is also made, for there are many purposes for which the carbon lamp is still more suitable than the metallic. Besides the brilliant display of lighted lamps on the stands, the company shows four large signs in the body of the hall, illuminated with 16-c.p. tungsten lamps. A large variety of fittings for incandescent lamps is also shown; we illustrate in fig. 169 the Ediswan outside fitting for metal lamps, suitable for street lighting and similar purposes.

Switchgear is another line in which the company has specialised for many years, and this is exemplified by numerous switches for switchboard and other uses. The "Phlatta" switch is shown in

Fig. 168.—Phlatta Switch.

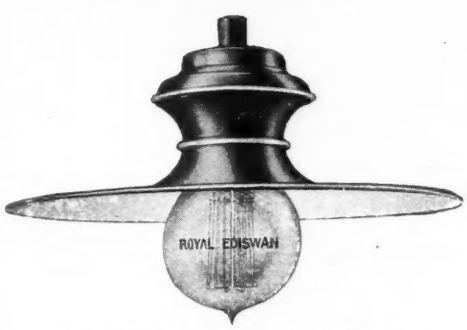


Fig. 169.—Ediswan Outside Fitting.

fig. 168, for house wiring and similar work; it is made on the firm's patent wedge system, and has the minimum amount of projection from the wall surface. It is made in round and rectangular patterns. A house service cut-out is shown in fig. 167, of simple and robust construction, and there are many other examples of fittings and accessories, lampholders, &c., as well as measuring instruments of the gravity and moving-coil types, switchboard instruments, galvanometers, batteries and portable instruments.

Robt. W. Paul (240),

New Southgate, London, N.

Mr. Paul's instruments are shown in great profusion, the exhibits numbering upwards of 150, of which more than two-thirds have been developed or redesigned during the past two years. The stand itself is flanked with showcases, the interior being fitted up as a working laboratory in which the apparatus is demonstrated.

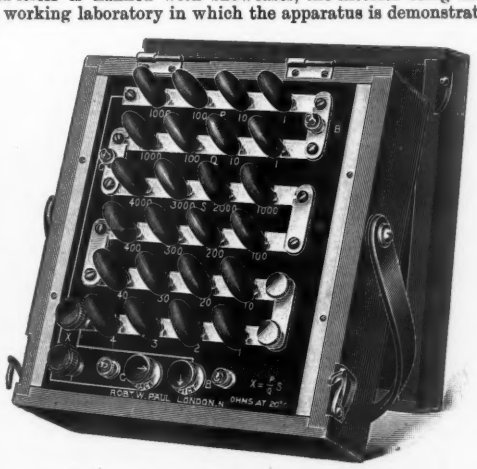


Fig. 170.—Paul Flush Resistance Box.

Among the instruments which have already received attention in these columns are the well-known Unipivot galvanometers of high sensitivity, test sets, milli-voltmeters and pyrometers. The last named are now made on the thermo-electric, resistance and radiation principles, in all of which important improvements have been introduced, tending towards simplification of use and of renewals.

For alternating-current measurement Mr. Paul has developed instruments both of the dynamometer type, and also on the thermo-electric principle; these are made for ranges as low as 10 milli-amperes for the full scale deflection, and put up in portable form with series resistances and shunts for general testing.

In redesigning the large range of testing apparatus, the opportunity has been taken to standardise all the components, thus securing greater efficiency at lower cost. As an example, we illustrate in fig. 170 a new construction of resistance bridge, in which the brass blocks are embedded and firmly keyed in a substantial slab of insulating material, thus ensuring that the plugs will fit always with their original accuracy, and presenting a flat and easily cleaned surface, in which there is no crevice to collect dust. The heads are moulded on the taper plugs, as shown in the detail views, fig. 171.

The novel terminal which we illustrate in fig. 174 is designed to

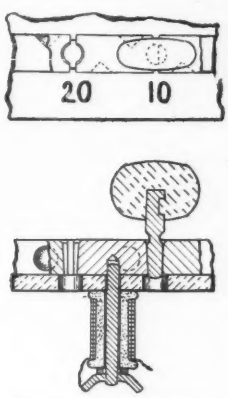


Fig. 171.—Details of Flush Resistance Box.

A, scale; B, pillar; C, tripod; D, lamp.

Fig. 172.—Scale Stand.

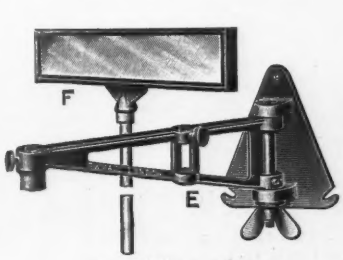
clamp stranded conductors as well as round wires of any size within its capacity; instead of tending to spread the strands as in the ordinary form, it compresses them into a solid mass in the tapering slot. The device is remarkably efficient, and should attract the attention of manufacturers of accessories as well as of instruments.

We also illustrate a novel type of scale stand, which is instantly adapted to work in any position on the wall or bench, and occupies a minimum space (figs. 172 and 173). The illumination is given by a 2-volt metal lamp with thick filament. Among the many other novelties we may mention the new Harris ohmmeter with generator, which has twice the scale length and range of the popular types. We are pleased to note that Mr. Paul has added another Grand Prix (at Turin) to his list of highest awards.

Messrs. T. & E. Wannbacher (308),

5, Appold Street, E.C.

Excellent examples of various precision movements are exhibited at this stall. Among those of most direct electrical interest may be noted movements for various indicating and recording instruments, for arc lamps, time switches and time elements, for electric one and two-rate meters, master and secondary clocks, signal clocks, Morse recorders and photographic frequency recorders. The quality, finish and cheapness of these movements are very striking, and we are informed that the makers are prepared to undertake any class of movement from samples or drawings.



E, socket for F, mirror.

Fig. 173.—Bracket for Scale.

Fig. 174.—Patent Terminal.

The Micanite and Insulators Co., Ltd. (322),

Empire Works, Walthamstow.

An interesting exhibit of their well-known insulating materials is shown by this firm, together with useful data concerning their dielectric properties. Specimens of natural mica, worked and unworked, are shown, as well as samples of micanite cloth and micanite tubes, rings, sheets and mouldings of various patterns. Other materials, such as "Empire" paper, tape, canvas and silk, red rope paper, presspahn, leatheroid and fibre plates, are also represented. The whole collection deserves close notice.

The Kingolite Co. (262),
118, 120, *Wardour Street, W.*

The "Kingolite" candle fittings are in use in the Royal Palaces and on board the *Olympic*, among other places. Carbon, tantalum and tungsten renewable lamps with screw sockets are available, and a special feature is the patent connector, which adapts the lamps to any standard candle socket, and by means of a screw flange

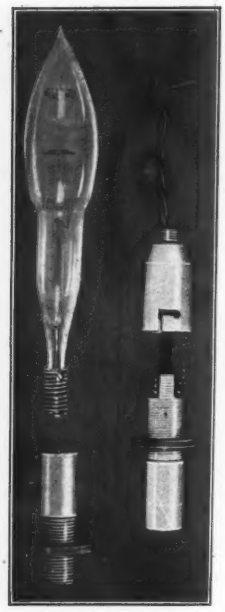


FIG. 176.

FIG. 177.

FIG. 175.—DETAILS OF CANDLE FITTING. ORDINARY AND SELF-LOCKING HOLDERS.

ensures perpendicularity and rigidity in the fitting. The "Kingolite" shade carriers as applied to bayonet lampholders dispense with screw rings by the use of spring plungers engaging in holes in the shade cap. An automatic locking-holder for B.C. lamps depends on the use of similar plungers; while easily manipulated by authorised persons possessing a release key, this holder affords ample security for shop and corridor lamps, &c. Fig. 175 shows the internal construction of the candle or holder fitting, fig. 176 illustrates an ordinary holder with shade carrier, and fig. 177 a cord-grip self-locking holder with shade carrier.

Mr. G. H. Alexander (295),
Doe Street, Birmingham.

Whitmore's belt dressing and similar compositions have been well known in this country for the past 10 or 12 years, but some four years ago there was introduced to the English market a gear-protecting and lubricating composition which has steadily grown in favour, though, by its very efficacy, it lacks many British testimonials, since gears to which it is applied have 80-85 per cent. longer life than if run with any other lubricant, and therefore frequently work two or three years before the full value of the protective composition can be judged. We understand that the

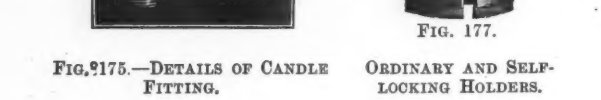


FIG. 178.—EXAMPLES OF PINIONS, SHOWING WEAR.

compound contains a high percentage of lead in a form which perfectly amalgamates with the grease employed; the material, as sold, runs when hot, but will not gum or clog; it produces a thin anti-friction film on the gear teeth, and protects the latter against abrasion and corrosion. Though English evidence is lacking, for the above reason, visitors can inspect illustrations of various American gears on which extraordinary, and perfectly authentic, results have been achieved. A gear and pinion, in service for over 3½ years on the Spokane and Inland Empire system, ran 194,700 miles, being lubricated by the Whitmore composition; in this time the pinion teeth wore 0·029 in. (mean), and 0·055 in. (maximum), while the gear teeth wore 0·026 in. (mean) and 0·06 in. (maximum). Referring to fig. 178, A represents a new inter-urban tramcar pinion; B represents a similar pinion after 29,286 car-miles, using Whitmore's composition; and C, another similar pinion after 23,078 car-miles (same track, load and season), with graphite grease. The pinion shown at D was lubricated with the composition, and ran 55,330 miles in nine months on the forward truck of a 32-ton high-speed inter-urban car.

The gear composition is supplied in various consistencies to suit different loads, but a valuable property of all grades is their indifference to moisture; in numerous instances the lubricant is applied to gears running in water. The material is already in use by many English industrial and manufacturing concerns, and a rapid extension in its application to tramcar gears is anticipated in the immediate future. Its high cost is only apparent, owing to its great durability and the gear economy effected.

Other interesting exhibits on this stand include chain, cam and wire-rope dressings, various shears and punches, and an example of the Dennis automatic boiler-damper regulator.

Oliver Arc Lamp, Ltd. (58, 65),
Cambridge Place, Woolwich.

The firm's standard product is, of course, arc lamps, and the well-known "Oriflamme" and other flame lamps find a place in the exhibit. The "Oriflamme" is a magazine lamp provided with an ingenious miniature "conveyor" for feeding the carbons, which has been frequently referred to in our pages; an improvement recently introduced is a carbon break switch in place of a mercury switch for controlling the circuit of the racking coil, by means of which the period of extinction for carbon changing has been reduced to 9 sec. The firm are making an exhibit of Varley patent coil windings produced on specially-designed machinery. The system briefly consists of winding, instead of a cotton or silk-covered wire, one or more bare wires in parallel with a silk insulating strand which separates and insulates each turn from its

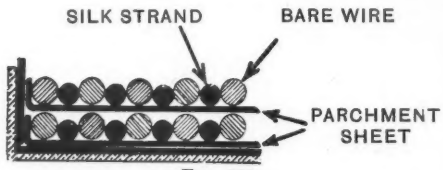


FIG. 179.

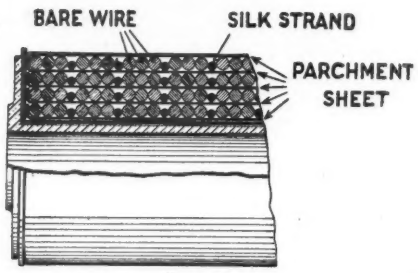


FIG. 180.

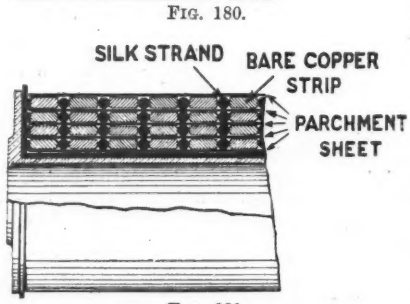


FIG. 181.
VARLEY PATENT COIL WINDINGS.

neighbour throughout the layer. Each layer of bare wire is insulated from the one below with a sheet of specially prepared highly insulating material, which is inserted by the machine on the completion of each layer of finished wires as the feed reverses to start the next layer.

The section in fig. 179 shows the simple application of the system to winding a single-wire coil. The very finest wires may so be wound—as fine as No. 50 S.W.G.—without the slightest fear of a breakage escaping attention.

Generally in practice two or more wires are wound in parallel, as shown in fig. 180.

In many cases a still greater number of turns may be placed in the same coil space by employing rectangular copper strip instead of round wires. This winding is illustrated in fig. 181. It is possible to wind coils with this strip down to an equivalent section to a No. 33 S.W.G.

The system particularly lends itself to the manufacture of windings intended to withstand severe mechanical and climatic conditions. In these cases coils are specially treated, according to requirements.

The main advantages claimed are the saving in space occupied, better insulation, absolute uniformity of product and reduced cost—the latter being usually less than the cost of covered wire alone, without winding.

As regards space saving, with coils wound as in fig. 180, at least 10 per cent. increase of turns can be obtained over a coil wound

with covered wires; and if wound with copper strip, as in fig. 181, an increase of 20-30 per cent. of turns can be obtained. It is no secret that these windings are in use by many of the best-known firms for small coil work of all kinds.

Amongst other things, the Oliver Co. are showing a selection of Vanalium castings. Vanalium is a comparatively new metal alloy possessing the lightness of aluminium, the ease of working of gun-metal, the general properties of bronze and the stiffness and tensile strength of wrought-iron and steel.

The metal is non-magnetic, and only a little heavier than aluminium; when cast, it has a tensile strength of over 11 tons per sq. in., while drawn Vanalium will withstand up to 33 tons per sq. in. Visitors to the Oliver stand can inspect a piano frame in this metal, and lift it too.

Engineering and Arc Lamps, Ltd. (327),

Chingford, Essex; St. Albans, Herts.

Gilbert and Davy flame and enclosed arcs are too well known and have been too often treated in these columns to need very detailed mention. The "Beacon" flame arc lamp has been brought

Fig. 182.—The "Beacon" Flame Arc.

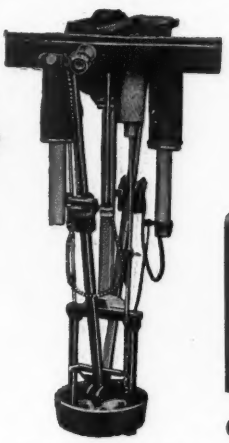


Fig. 183.—Mechanism of the "Beacon" Arc.

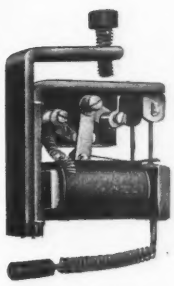


Fig. 184.—The "Attractor."

to such perfection that it is sold under a three years' guarantee. The four standard sizes burn 11, 17, 24 and 35 hours respectively, and may be burned in series without idle line resistance. Great current economy is thus secured; carbon costs are very low, the globe is free from deposit, and the lamp runs satisfactorily on 25 cycles or even lower frequencies. As shown by fig. 183, the internal mechanism of the lamp is very simple and robust, while visitors will themselves observe the elegance of the external appearance of the whole. No clockwork feed is employed, and the moving parts are totally enclosed from the arc fumes.

The various suspension and other fittings used in conjunction with the lamps made by this firm have proved so satisfactory in the past that visitors will notice few novelties in this branch of the exhibit. Continental and American, even more than English, engineers will be interested in the latest patterns of constant current transformers, for series A.C. arc lighting, and "automatic regulator," or moving-coil choker.

An interesting advertising novelty is to be found in the "Attractor," fig. 184. In conjunction with any flash-light advertising sign, a small electromagnetic hammer, built exactly on the principle of an electric bell, is used to set up a sharp, insistent rapping on the glass of the sign during the time the lamps are extinguished, thus attracting the attention of passers-by. The device is simple and cheap to install and use, and is certainly very effective; it has many obvious applications other than that suggested.

Brook, Hirst & Co., Ltd. (153),

Chester.

This firm's stand is fully occupied with "Brookhirst" ironclad starters of various designs and other switchgear suitable for motor-users. The firm's standard pillar type panels are substantially constructed in various patterns for constant and variable speed motors, and will well repay careful inspection on the part of prospective users of such apparatus.

We illustrate in fig. 185 one of their constant-speed wall-pattern panels fitted with a B type "no-volt" release starter and dead-beat ammeter in the upper part, and with a D.P. interlocked no-volt and overload release circuit-breaker in the lower portion. A press button release is provided, also a laminated copper swivel final contact for the starter.

It may be explained that all the firm's standard panels are provided with a starter having a "no-voltage" release independent of the motor field current; a D.P. magnetic blow-out circuit-breaker, with "no-volt" and "overload" releases which are perfectly free to act either during or after the operation of starting; and an overload preventor, which, by tripping the circuit-breaker, prevents too rapid starting, and is therefore a substitute for a slow motion device.

The equivalent of the "loose handle" circuit-breaker is obtained by interlocking the starter and no-volt circuit-breaker, so that the latter can only be put "on" when the starter is "off," and the starter put "on" when the circuit-breaker handle is free. By using a "no-volt" circuit-breaker, the solenoid type overload preventor can be made to operate by opening the "no-volt" release circuit. Fuses can safely be dispensed with, but where it is desirable to introduce the equivalent of their delay action, a further overload trip is fitted in the form of a thermal element with adjustable time lag. When this device is introduced it is connected in the opposite pole to the solenoid trip and is absolutely independent of it.

Under certain exceptional conditions, a slow motion starter is considered desirable, and a fine example of the firm's work embodying this feature is shown in fig. 186, representing a standard constant speed multiple lever type motor-starting panel, with "step-by-step" starter and slow-motion ratchet handle.

Each of the levers, in the upper portion, is fitted with a main copper plate contact and auxiliary copper sparker, and the fixed contacts each have a main laminated copper brush and auxiliary carbon sparker—contacts and sparkers being all renewable. A D.C. electrically operated no-volt and overload release circuit breaker, with trips to both poles, is fitted in the lower chamber, where the middle switch is the final contact of the starter. An 8-in. dead-beat ammeter is also provided in the upper chamber.

As previously mentioned, a great variety of the other switchgear is on view.

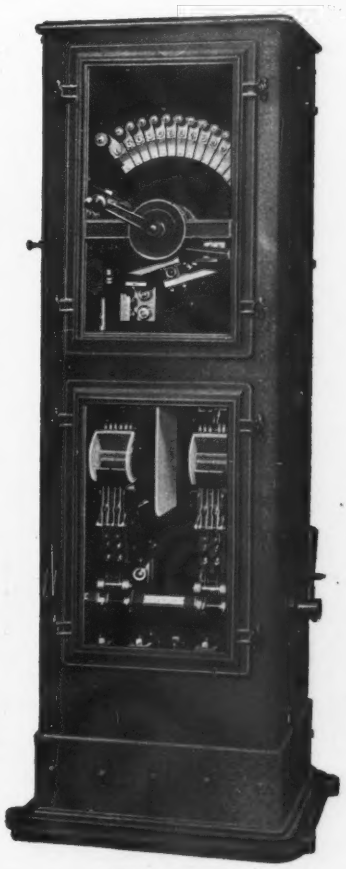


Fig. 185.—"Brookhirst" Standard Starting Panel.

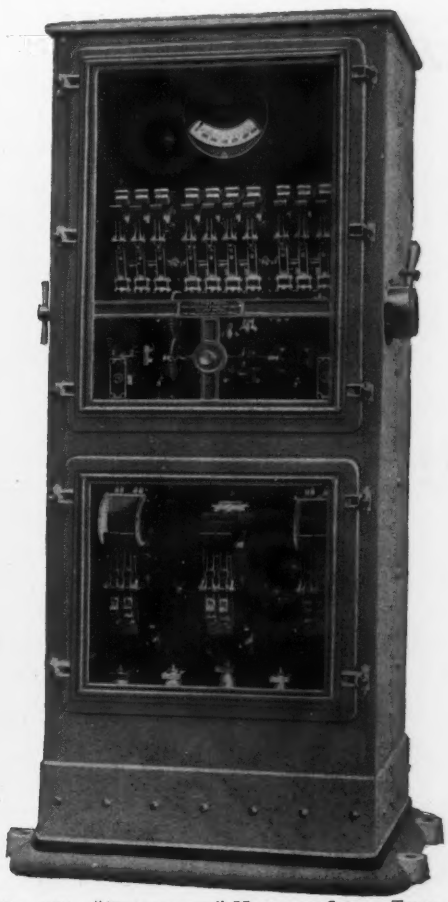


Fig. 186.—"Brookhirst" Multiple-Lever Type Starting Panel.

The British Prometheus Co., Ltd. (197, 218),
Salop Street Works, Birmingham.

In this exhibit we find a most substantial and imposing display of electrical cooking apparatus on the grand scale. Most prominent is a large cooking range capable of cooking for no fewer than 60 persons; it is shown in fig 187, and consists of roasting and baking ovens, griller and toaster, water boiler, &c. It presents a striking appearance, as all the facings are nickel-plated, and the top of the range is polished. The roasting oven is 20 in. wide × 19 in. high × 22 in. deep, and has a cast-iron interior, with white porcelain enamelled ribbed plates round three sides; the heating elements are fixed behind these plates. At the top of the roasting oven is a radiator for browning joints, &c. The oven has a large glass inspection door, through which the whole of the interior can be seen, and an outer iron door, and a thermometer is provided. The baking oven is similar, but without the glass door and top heater, and both ovens contain the usual fittings. Between them is a cast-iron water tank containing an electric heater, on the continuous hot-water supply system, and above the boiler is a Silundum toaster in three sections, separately controlled; this, taking the place of the coal-fireplace, gives a familiar aspect to the range. Above the toaster again is a nickel-plated grill, and on either side of it is a polished hot-plate—one for simmering, the other for boiling. In the top of the recess in which the range is fixed is a hot cupboard for plates, &c. The range has a possible maximum demand of 17 KW., but takes only 6 or 8 KW. in normal use, and ample regulation is provided by means of a set of switches. This range is shown in operation every day. It is not the largest made by the company, for they have supplied ranges capable of cooking for as many as 500 persons, but it admirably shows the enormous progress that has been made in electrical cooking—such ranges would not be made unless they were in demand.

Adjoining the large range there is an electrical steam generator, taking 15 KW. to heat it to a steam pressure of 15 lb. per sq. in., which is accomplished in 15 minutes. This works in conjunction with an ordinary steam cooker, having a capacity of 1 cwt. of potatoes, in two compartments. About 5 KW. is required to maintain the steam supply during cooking, at a working pressure of 8 or 10 lb. The boiler is fitted with an automatic valve which admits water from the mains as required.

FIG. 187.—ELECTRIC COOKING RANGE FOR 60 PERSONS.

FIG. 189.—BRITISH PROMETHEUS CONVECTOR.

FIG. 188.—DOMESTIC ELECTRIC COOKER.

FIG. 190.—METCALFE SPEED INDICATOR.

Another exhibit is a domestic cooker of more ordinary dimensions—capable, however, of cooking for 18 persons. We illustrate this in fig. 188. It takes a maximum of 4·5 KW. The oven is generally similar to the roasting oven described above, and on top of it there is a space for warming plates; above this there is a grill, frying pan and simmering and boiling plates. The oven is 16 in. wide × 18 in. high × 16 in. deep. A plate warming cupboard taking up to 3·5 KW., with a heated carving table on the top, and a cast-iron stock pot containing 12 gallons, taking 6 KW. to heat up, and 2 KW. to maintain the temperature, are also shown, besides a variety of smaller cooking utensils, artistic afternoon tea tables, &c.

Fig. 191.—Century Testing Set.

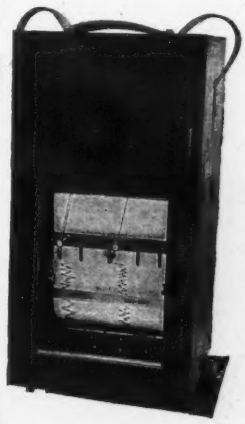


Fig. 192.—Elliott Bros.' Recorder with 6-in. Chart.

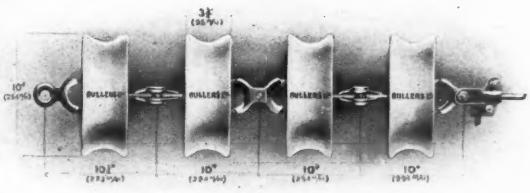


Fig. 193.—Bullers' Strain Insulator.

Mention must be made of the numerous patterns of convectors with which the company's name has so long been associated; these are heated with elements consisting of pure inoxidisable metals deposited on mica, which have a long life. We illustrate one of them in fig. 189—a polished copper convector, controlled by three switches, and illuminated inside by a ruby lamp giving a cheerful glow.

Elliott Bros. (54, 69),
Century Works, Lewisham, S.E.

A very interesting collection of apparatus is shown by this firm, including as it does many novel features. The Anschutz gyro compass is, of course, the most noteworthy innovation; it consists of a gyroscope driven by a three-phase motor, and provided with an ingenious damping device, to prevent oscillation. It is absolutely unaffected by magnetic influences, and therefore points to the true north in all parts of the world. Possessing considerable directive torque, it can be used to transmit controlling currents to subsidiary compasses in other parts of the ship, and to show deviations from a predetermined course on a greatly magnified scale. This instrument is one of the most beautiful applications of science to industry that we have ever seen. It is in use in the British and other Navies.

Messrs. Elliott Bros., in fact, devote a good deal of their show to naval and mercantile apparatus. The Forbes log, for instance, is a combined speed indicator and distance recorder; it is operated by a small propeller fixed in a kind of Pitot tube, which can be protruded through the hull of a ship. The propeller drives a magneto dynamo which gives the speed indication on a voltmeter calibrated in knots, while an intermittent contact device actuates a step-by-step recording instrument, showing the distance covered in miles. Any number of the instruments can be operated from a single magneto, and can be situated anywhere in the ship, simple means being provided to adjust the circuit resistance to suit the number of indicators in use. When not required, the tube can be pulled inboard and the outlet closed with a valve.

Engine room telegraphs showing the speed ordered to one revolution from 40 to 140, and provided with check reply, are shown; these operate by an electric step-by-step device, and work accurately at any distance apart, unlike mechanical telegraphs. The Metcalfe speed indicator (fig. 190) is an allied apparatus of much interest, used to show whether the speed at which the engines have been set is correctly maintained. A friction disk is applied to a cone driven by the engine, and in turn drives a clock round the same axis as a pointer driven by the clock in the opposite direction. Thus, if the speed of the clock and that of the hand are equal and opposite, the latter will remain stationary, pointing to a mark, while if the clock rotates too slowly or quickly, the pointer will move one way or the other, indicating loss or gain of speed. The friction disk is set to the correct speed marked on the dial, and the engine is regulated so that the pointer remains stationary, the speed of the engine being then constant—an important matter nowadays, when the speed of revolution of the propeller is used as an approximate measure of the speed of the ship.

Other interesting items are the Wimperis recording accelerometer, which registers the acceleration and retardation of trains or tramcars over any distance, the superelevation of rails on curves (when the instrument is fixed transversely), and so on; and the Century testing set (fig. 191), which is accurate to ½ per cent., and reads to various ranges of amperes and volts, besides affording a check test between the two measurements; spare shunts are carried in a separate case readily hooked on to the main instrument, which is of shallow depth so as to be easily carried. Fig. 192 shows a recording instrument with chart 6 in. wide, which can work off an ordinary ammeter shunt; the chart is driven by a pin-wheel, which the makers find the only satisfactory method, and the pen is very light and easily cleaned. These recorders can be arranged as a "feeder log" with volt and ammeter records, or battery charge and discharge with cell voltage

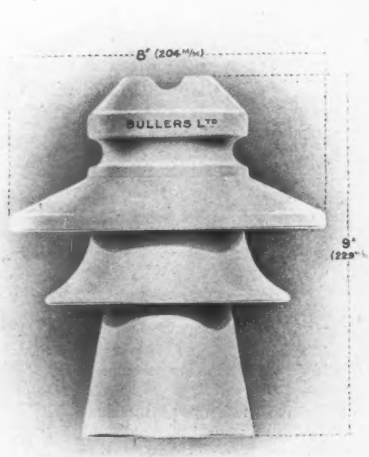


Fig. 194.—Pin Type.

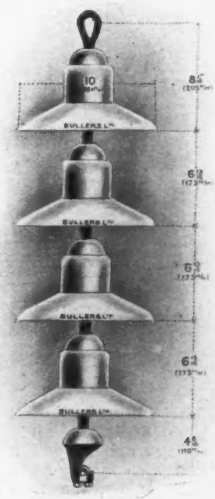


Fig. 195.—Hooded Type.

Bullers' High-Pressure Insulators.

chart. Micrometer gauges accurate to $\frac{1}{10000}$ in., at moderate cost, with a triple coating of japan to prevent heating by the fingers when in use, and many other interesting instruments are shown.

Messrs. Bullers, Ltd. (118, 141),

6, Laurence Pountney Hill, E.C.

This stand is very much up-to-date, for on it are shown, for the first time in this country, we believe, insulators for overhead transmission lines of over 100,000 volts. The firm has, of course, long

FIG. 196.—E.A.C. HIGH-TORQUE D.C. METER.

specialised in the manufacture of porcelain insulators, and makes large quantities of these for the British Post Office, as well as other authorities, for telegraph and telephone lines; pin type insulators are also exhibited for pressures up to 50,000 volts, in standard patterns, one of which is illustrated in fig 194. The

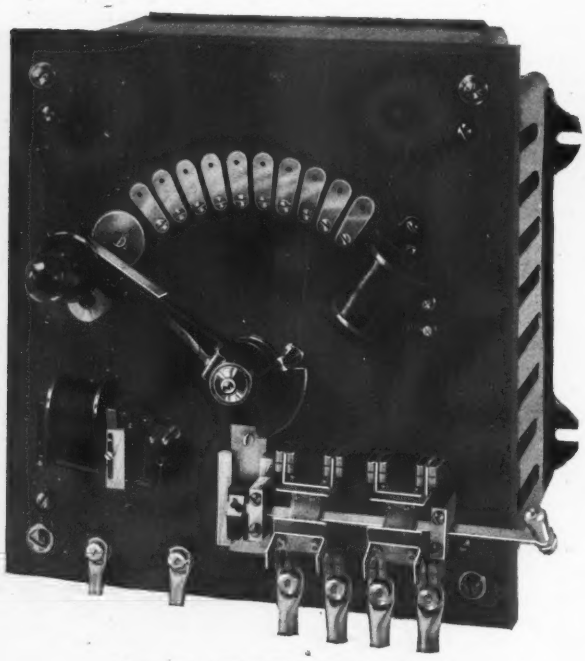


FIG. 197.—E.A.C. REVERSING STARTER.

novel feature is the introduction of the suspension type of insulator, which has successfully solved the problem of insulating the lines at extremely high pressures now in use in the United States and elsewhere. As licensees of the General Electric Co., of Schenectady, the firm show the type of insulator, in which the flexible steel loops are interlinked, so that the breakage of an insulator would not allow the line to drop. Messrs. Bullers show also a pattern made under their own patents, which we illustrate in fig. 195. In this case the porcelain is not perforated, the metal parts being securely attached to the porcelain by suitably cemented joints. This is known as the "metal-hooded" type of suspension insulator. Both types are capable of withstanding a pull of three tons, and a Denison testing machine on the stand is used to prove the truth of this assertion. The foregoing types are intended for use in the vertical position; fig. 193 shows one for use as a strain insulator, in an approximately horizontal position. With these insulators practically any pressure can be provided against, the value depending upon the number of insulators put in series. A transformer on the stand is employed to carry out tests up to 85,000 volts, on insulators subjected to a heavy shower of water, demonstrating their ability to withstand the pressure and to prevent flashing-over. We understand that the suspension type of insulator has already been brought into use on transmission lines in this country, though not at such high pressures as are used abroad. Messrs. Bullers claim to be the only firm in the world that can put their unglazed insulators through exactly the same tests as when glazed—the insulation depending upon the perfect vitrification of the porcelain, and not at all upon the glazing. Various types of shackle and other insulators are also shown, and an interesting feature of the stand is a tall steel lattice tower—some 40 ft. from the ground level—fitted with three cross-arms.

Electrical Apparatus Co., Ltd. (24, 37),

Vauxhall Works, South Lambeth Road, S.W.

Standard and prepayment meters, a variety of motor-control gear cinematograph resistances, and fuse specialities form the basis of this exhibit. In the motor-control line, the company cover a wide field of usefulness, and in addition to the various controllers shown on this stand, engineering visitors should take the opportunity to examine their latest induction controller for slip-ring induction motors, which was recently described in our pages, and is shown in use on the adjoining stand of the Homopolar Co.

FIG. 198.—E.A.C. "ONE-MINUTE" MOTOR STARTER.

We illustrate in fig. 196 an E.A.C. high-torque D.C. meter fitted with a new terminal box. This is an integrating motor-meter of the ampere-hour type, in which the moving element consists of an armature rotating in a field of two permanent magnets, current being led in by two 18-carat gold brushes bearing on a miniature commutator built up of gold segments. The armature is connected across a main shunt which is in series with the load.

The moving element is exceeding light, and the meter is claimed to start on considerably under 1 per cent. full load current—a feature of importance in view of the general use of highly economical lamps.

A new 1911 pattern "one-minute" motor starter, fitted with carbon break and magnetic blow-out, is shown in fig. 198. In this the slow motion is attained by a pawl carried on the lever, and moving in a zig-zag slot which necessitates a quick forward movement and dead stop in the centre of each segment, but does not interfere with backward movement. The resistance is rated for a 60-sec. start at 50 per cent. overload every three minutes.

These starters are built in sizes up to 50-75 H.P., and in open, semi-enclosed and totally enclosed (gas and watertight) patterns.

A further example of the firm's apparatus is shown in fig. 197, representing a reversing starter for series or short-wound motors. The reversing switch and starting lever are interlocked, so that the former must be properly closed in one direction or the other, before the starting arm can be operated, while the latter must also be in the "off" position before the reversing switch can be operated.

Messrs. Krausse & Auerbach (323),

45, Basinghall Street, E.C.

Steatite, china and earthenware parts for electrical accessories, &c., are shown in great diversity; and special designs, in wholesale quantities, are undertaken to order.

Messrs. Pooley & Austin (49, 74),
25, Victoria Street, S.W.

The very comprehensive exhibit of this firm is composed of typical manufactures of three of the firms for whom they act as London office, viz., Messrs. Mawdsleys, Ltd., of Dursley; Messrs. Spagnoletti, Ltd., London; and Messrs. Engineering Instruments, Ltd., of Darlington.

Messrs. Pooley & Austin supply complete electrical equipments for factories, country houses and similar situations, and their leading exhibit is a 80-H.P. four-cylinder paraffin engine coupled to a 50-KW. Mawdsley dynamo. This set runs at 500 R.P.M., and is fitted with magneto ignition; it starts on petrol or by means of a blow-lamp. Water cooling is largely employed, and the lubrication is on the gravity circulating system, with an oil pump and oil strainer. The makers of the engine obtained considerable renown in connection with the plant supplied to *Maple Leaf III*, the fastest boat in the world. In contrast to this set is a ½-H.P. one, coupled to a 250-watt dynamo, and suitable for bungalow or yacht lighting; several electrically-driven pumps are also shown.

The Mawdsley exhibit includes several other machines for special uses, and ranging in size down to a ¼-H.P. motor, for 1,000 R.P.M., which, despite its diminutive output, is as scientifically and carefully constructed as its larger brethren near-by.

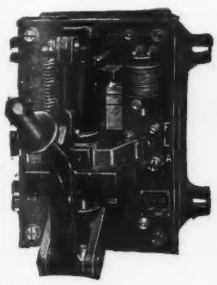


Fig. 199.—The "Direkton" Starter (Engineering Instruments, Ltd.).

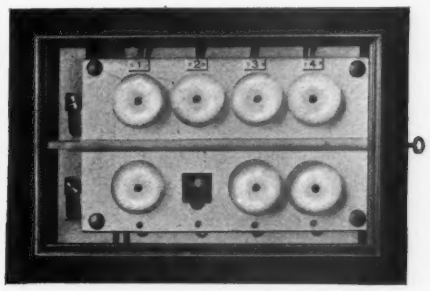


Fig. 200.—Home Office Type Fuseboard (Spagnoletti).

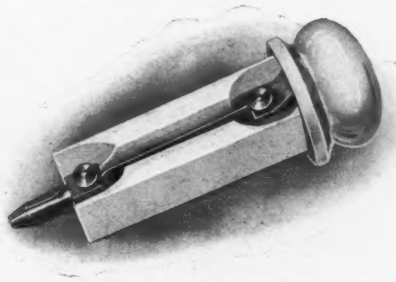


Fig. 201.—Indicating Fuse Plug for H.O. Fuseboard.

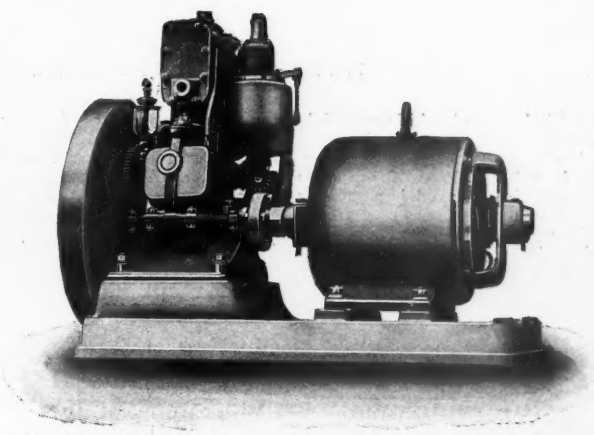


Fig. 202.—Country-House Generating Set (Pooley & Austin).

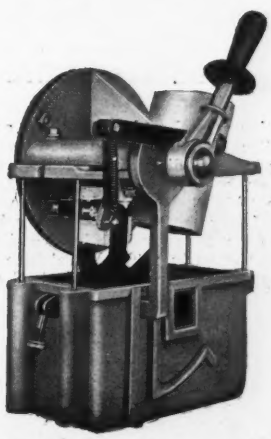


Fig. 203.—Oil Switch, with Tank Lowered (Spagnoletti).

Messrs. Engineering Instruments' exhibit consists principally of ironclad, heavy-type motor-control gear, in panel or pillar form.

A large ironclad motor-control panel for 50 H.P. is shown. This is divided into three sections, the upper one carrying an ammeter with double-pole fuses and double-pole quick-break main switch; the central one contains a massive starter with no-volt and overload releases; and the lower one contains a shunt regulator for speed variation.

Open, semi and totally enclosed "Direkton" starters are on view, the great advantage of these being that one motion on the part of the operator only is necessary to switch on the motor. When the starting handle is pressed home, a spring is compressed, and this spring drives the starter arm over the contacts against the suction of a totally enclosed oil dash-pot. Thus the operator has no control over the speed at which the resistance is cut out of the armature circuit, and the overload and no-volt releases are operative during the whole time of switching on.

There are examples of a new standard type of starter just brought out by this firm, in which the interesting feature is a special type of easily renewable contact. To renew any one of these contacts, it is only necessary to take out one screw, and there is no need to touch any nuts at the back of the starter.

In another section of the stand are the switchgear and instrument exhibits of Messrs. Spagnoletti, Ltd.

These include a three-phase 6,000-volt stone cubicle switchgear for central station use, and a smaller 2,000-volt ironclad sub-station panel. In the case of the former it is necessary to switch off before the isolating switch chamber can be opened, and the latter operation automatically withdraws the isolating switches, thus safeguarding the operator as far as possible when a switch panel has to be made "dead."

The low-tension switchgear comprises examples of generator and feeder panels, accumulator regulating boards, circuit-breakers and distribution switch and fuseboards. Feeder pillars represent types used on systems of distribution for street lighting and traction. A new speciality is a type of switch having a quick make as well as quick break, the switch itself carrying a fuse if required. Another new line is a three-phase oil switch having a quick make and break, and fitted in an iron case having a locking arrangement so that the switch must be in the "off" position before the case can be opened and whilst opened; the case is watertight and gas-tight, and the oil tank slides down on runners, thus catching any oil dripping from the switch, see fig. 203. This form of switch can also be fitted with fuses.

Another and new exhibit is the "Bowie" safety lamp re-lighter for electrically re-lighting miners' lamps without danger of explosion, fig. 204. The generator is interlocked with the case, so that it can only be operated when the case is closed perfectly gas-tight; the lamps are fitted with special contacts for obtaining the small spark necessary in the lamp, and the operation is perfectly safe. In addition to their exhibit in the body of the hall, Messrs. Spagnoletti are showing on Stand 311, in the gallery, the Therol system of electric heating, with which our readers are already well acquainted.

The system is essentially a heat-storage one, and, in addition to the original purpose of water heating, it has now been developed for cooking.

The cooking apparatus is made on the same principle as the water heater. The current for the cooker when not being used is taken in heating the iron mass placed below the oven. When the oven is required to be used it is merely necessary to open two dampers, and the oven in a few minutes reaches the required temperature—from 300 to 400° F. By adjusting the dampers the heat can be regulated in the oven to any required temperature. We illustrate in one of our views (p. 616) the firm's cooker.

Messrs. Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd. (179, 184, 206 and 209),
Caxton House, Westminster, S.W.

This is one of the largest and most varied exhibits in the hall; in the main it consists of examples of the numerous accessories and supplies and current-consuming devices of which these companies offer so wide a range, including cables and wires, telegraph and telephone apparatus, railway signals, arc and incandescent lamps, X-ray apparatus, heating and cooking appliances, motors, batteries,

testing instruments and fittings. Under the first heading, the "Stannos" wiring system, which has attained such wide popularity, is, of course, a prominent feature, a large panel being wired with this material so as to show its capabilities. Of the telephone apparatus, which is made at Woolwich, besides domestic and inter-communication sets, there are long-distance telephones for exchange and railway use, and an all-metal cased central battery set, of which we give an illustration in fig. 208, on the opposite page. Water-tight and gas-tight telephones of exceptionally robust

FIG. 204.—BOWIE SAFETY-LAMP RELIGHTER.

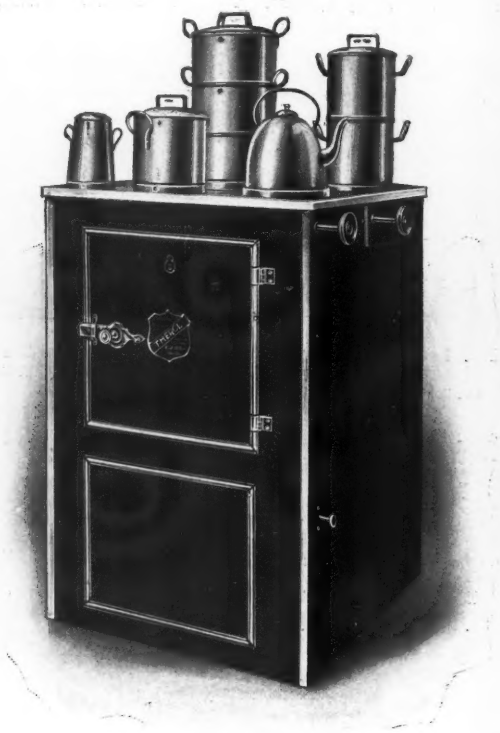


FIG. 205.—THEROL ELECTRIC COOKER.

construction are also shown; these are suitable for collieries and similar places, and a special marine pattern, with loud-speaking trumpet dispensing with a separate receiver, is shown for use on board ship (fig. 210). The largest exhibit in this line is a "high-tension" cabinet, in which all the apparatus is most efficiently protected against the incursion of high-pressure current from transmission lines carried on the same poles as the telephone wires (fig. 209). Wheatstone transmitters and receivers driven by small electric motors instead of clockwork actuated by

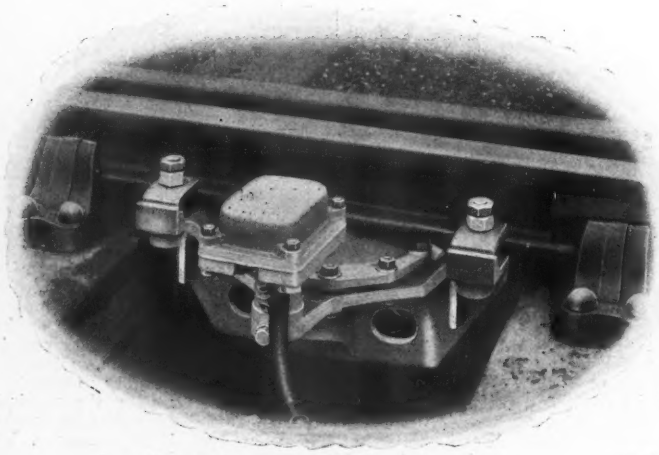


FIG. 206.—SIEMENS MERCURY TREADLE.

springs or weights form a novel feature of the telegraph exhibit, being shown in operation; these are energised from the batteries used to feed the line circuits, and take from 5 to 7·5 watts at 30 volts, running under the control of a mechanical governor which ensures extremely steady speed.

Standing out prominently above the stand is a full-size railway signal, which is operated by a dozen dry cells under a new system, patented by the company; the apparatus, which can be applied to any existing signal, consists of a small motor driving the signal arm through a train of gearing, so that the power required is very small—about 30 watts—the operation of lowering the signal being spread over 4 or 5 seconds. When lowered, the signal arm is held down by an electromagnet which brings a pawl into gear with a large wheel forming part of the gearing, and the motor is cut out. When the signalman replaces his lever, the circuit of the magnet is opened, the wheel is unlocked, and the signal arm returns to the danger position; the same thing happens if the battery circuit is opened by any means, so that any derangement of the apparatus always puts the signal at danger. In the act of returning to this position, the mechanism raises the armature of the magnet close to the poles, so that a long pull is not necessary when the signal is actuated again, and thus the magnet does not require a large current to actuate it. As a battery of Siemens-Obach cells will work the mechanism twice an hour for 120 days of 24 hours each, without falling off more than 10 per cent., it will be seen that the cost of power is very small. A mercury contact treadle, used for actuating signals on the passage of a train over the line, is exhibited, and is illustrated in fig. 206.

FIG. 207.—STANDARD MOTOR-CONTROL PILLAR.

Amongst the domestic apparatus is a pumping system for country houses, in which each tap is furnished with an electric device which starts the motor and pump whenever the tap is turned on, thus providing a constant supply of water without necessitating the

use of a large storage tank at the top of the house. Another set, with which a tank is used, is fitted with an automatic float apparatus for controlling the motor, so as to maintain a supply of water in the tank. A mining switch pillar for voltages up to 3,300, and a current of 300 amperes, is exhibited; this is of the draw-out type, so arranged that when the switch carriage is in the forward position, the switch is entirely dead, and a safety interlocking device prevents the switch from being put back unless it is in the off position, while the carriage cannot be withdrawn, until the same condition is fulfilled, and the oil tank and the cover cannot be removed until the carriage is drawn forward. The switch is of the free-handle type, so that it cannot be held in on an overload. Various combinations can be made in this class of apparatus, which is shown in fig. 211. An automatic starting switch is shown for a D.C. motor in which, after the main switch is closed, the resistance is cut out by steps under the control of a 'scape wheel and balance wheel. We illustrate in fig. 207 a standard motor control pillar with D.P. switch and fuses, starter and ammeter. A small loom motor, of the company's standard three-phase type, mounted with elastic suspension on a cradle, is another exhibit in this department.

Zed fuses are shown in operation, and the "Vortex" vacuum cleaner, which is operated by a central motor-driven plant, and is provided with a water supply pipe to carry the dust into the drains forms a popular attraction. This system can be fitted for almost any number of points, which are connected to the central plant by piping, and is in use in many large buildings in this country. A portable apparatus is also made. Non-encrusting zincs, primary cells, overhead line material, instruments and transformers are other items of this extremely diversified exhibit.

We gave particulars of the result of the Siemens lamp poster competition a few weeks ago, and last week the lamp and fittings exhibit by the Dalston works was reviewed. In view of the interest that the above competition evoked, we have succeeded in finding space to illustrate the prize-winning posters below. One—Little Bill—is really humorous, and is intended to be so; the other, that of the dread eclipse, is intended to be quite superior and impressively serious, but it may strike you either way—it all depends upon your point of view, and whether you are interested in another lamp or not. Contractors who want copies of these posters to display in their establishments will soon be able to have them attractively reproduced on thick card in several colours, varnished, eyeleted and strung

Fig. 208.—Metal-Cased Telephone.

Fig. 209.—"High-Tension" Cabinet.

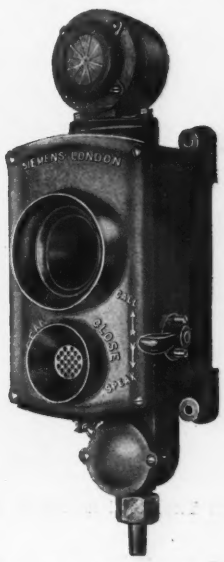


Fig. 210.—Loud-Speaking Marine Telephone.

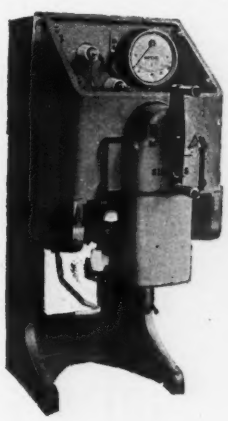
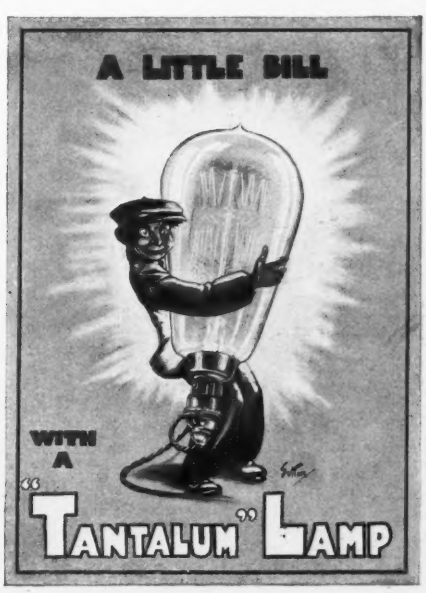


Fig. 211.—Mining Switch Pillar.



Figs. 212 and 213.—Prize-Winning Posters in the "Tantalum" Competition.

Bertram Thomas (22 and 39),
Worsley Street, Hulme, Manchester.

The stands occupied by this firm are filled with apparatus of a novel character, and containing mechanical devices and features which are of unusual interest.

An automatic battery regulator switch is shown, for keeping the voltage of supply from accumulators constant, or for operation from a distance; a similar but somewhat modified gear may be employed

for the voltage regulation of generators boosters, balancers, &c. The governor or voltmeter section works without the intervention of relays, and turns the operating current direct on to one or other of two solenoids, which, in their turn, move the main contact arm to cut cells into or out of circuit as required. The governor *makes* contact only, and the resulting current is broken in a magnetic field on special renewable carbon contacts placed on the battery switch.

The governor can be compounded to allow for drop of pressure in a feeder, which is very useful when the battery is placed at a distance from the distributing centre.

The regulating switch itself which carries the main current is arranged with either one or two main contact arms, according as the switch is required for discharge only, or for charge and discharge occurring at the same time. The contact arms pass from step to step by an instantaneous movement allowing no time for burning.

An interesting example of a 350-H.P. three-phase automatic starter is shown (fig. 215), embodying the firm's special features of quick movement from step to step, and protection of the main contacts from burning by means of well designed and carefully placed auxiliary contacts which take all sparking. The moving arms carry contacts of the controller finger type, and the process of starting consists of a series of rapid movements from contact to contact, the time taken to start up being determined by the length of time during which the contact arms are allowed to dwell upon each step; this time is readily adjusted to suit the motor and its particular service.

These starters are used for automatically controlling motors driving air compressors, hydraulic accumulators, pumps supplying or emptying tanks, &c., or for remote operation. In many cases, also, it is more satisfactory to make the starting of motors automatic rather than dependent upon the discretion of unskilled attendants.

A panel is shown containing the necessary gear for controlling an air-compressor motor, and thereby maintaining the air pressure constant between certain limits, say, between 95 and 100 lb. This comprises an air-pressure limit switch in which the air pressure acts directly upon a piston, and is balanced against weights to

FIG. 214.—BERTRAM THOMAS ELECTRIC OVEN.

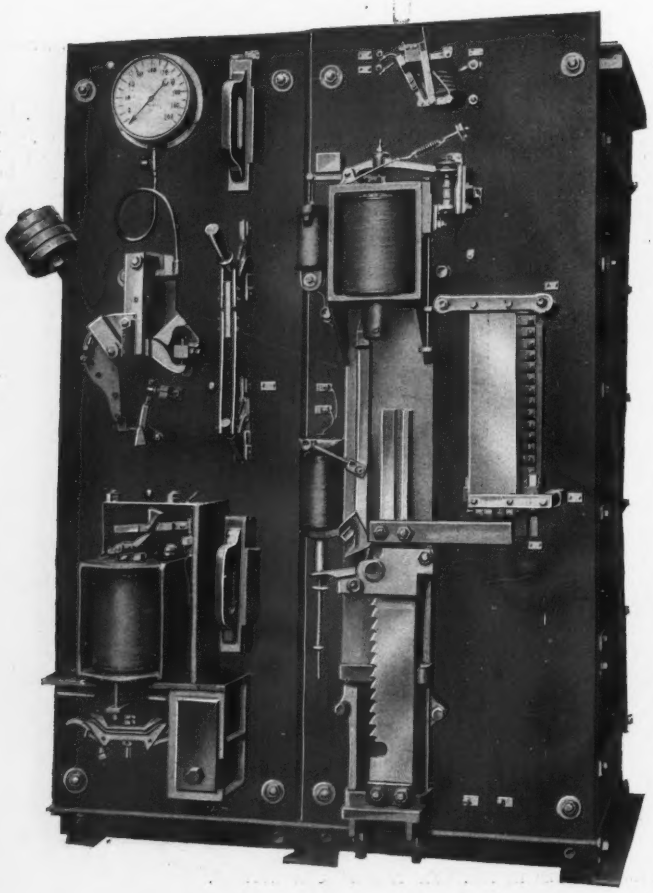


FIG. 215.—BERTRAM THOMAS THREE-PHASE 350-H.P. AUTOMATIC STARTER.

FIG. 216.—TABLE LAMP.

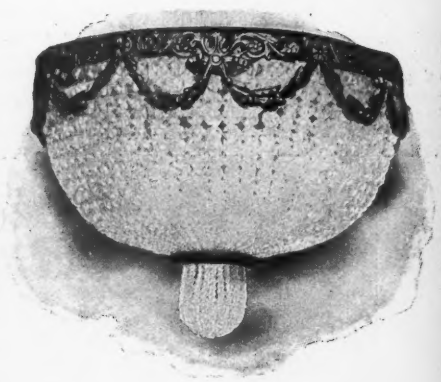


FIG. 217.—CRYSTAL CEILING FITTING.

FALK, STADELMANN FITTINGS (see next page).

maintain the desired air pressure and range. The forces actuating this switch are very powerful, and its operation is therefore very certain. It opens or closes quick make and break switches, which operate a solenoid main switch, and thereafter set the automatic starting switch to work with its step-by-step action.

Direct-current auto-starters are shown of various sizes up to 400 H.P., as well as ratchet starting switches for hand operation with double-pole overload circuit-breaker and no-voltage release, and circuit-breakers of all sorts and sizes for hand operation or remote control, and with or without time limit.

The "gold medal" cooking oven with patented internal air circulation is shown at work, and an adjoining table is spread with the appetising results produced. The oven has an internal size of 20 in. high × 18 in. deep and 15 in. wide, is heavily lagged so that its outside is kept cool, and carries at the top a plate-warming closet and two hot plates for boiling or frying.

A large electric oven made by Mr. Thomas is illustrated in fig. 214 opposite.

Messrs. Falk, Stadelmann & Co., Ltd. (80),

83—87, *Farringdon Road, E.C.*

This company has, in effect, transported a portion of its new showrooms to Olympia, the stand containing a comprehensive exhibit of fittings and accessories on showroom lines. The internal and external panels which form the walls of the room are utilised for a display of electric bells, telephones, &c., and bracket fittings, while from the ceiling depend a variety of electroliers and pendants, with concealed wiring as though installed on consumers' premises. Small tables and the floor itself provide support for table lamps and floor standards, and the "Efesca" tungsten lamps pervade the whole exhibit, forming also a very striking sign on the facia.

Fig. 218.—"Noturn" Ball Joint.

Fig. 219.—Pocket Fuse-wire Holder.

Some examples of the fittings are shown in the accompanying illustrations, page 618, representing a very handsome four-light crystal fitting (fig. 217), and a table standard in oxidised silver (fig. 216). The company also makes a speciality of "period" fittings, which are designed to suit individual requirements. The "Efesca" flat wall switch which is exhibited is a line of which the company is proud, and the neat little fuse carrier, which we illustrate in fig. 219—a device which enables a sufficient store of fuse-wire to be tidily kept at hand—is a convenient little appliance for either consumer or wireman. Special switches made to conform to the Home Office requirements are shown, the earthing connections and shock-proof features of these being noteworthy. One bay of the stand, containing a show of glassware, is illuminated with reflected light from above. Our other illustration, fig. 218, shows a patent "noturn" ball joint, which is particularly useful for outside lamps, as it prevents the twisting of the flex.

Messrs. Pirelli, Ltd. (172, 191),

45, *Basinghall Street, E.C.*

This well-known Italian firm is making a special display of power, telegraph and telephone cables. The mains engineer will view with great interest a large drum of 75,000-volt three-core cable which occupies a prominent position on the stand. This cable is jute insulated, paper and lead-covered, and steel armoured, and the numerous other examples of the firm's work range through all grades down to fine silk-covered wire for delicate instrument work. The company also specialises in rubber and ebonite goods, and substantial motor tires and a variety of ebonite telephone and other fittings bear witness to its activities in these directions.

The Pirelli Co. has several factories in Italy and other countries, and employs some 6,000 hands; a series of illuminated views will help to impress the visitor with the wide scope of its operations.

The Earth-Driven Clock Co. (307),

11, *Bowling Green Street, Leicester.*

The energy driving the electric clock exhibited by this firm is derived from a zinc-carbon couple buried 3 or 4 ft. deep and about 1 ft. apart in moist soil; in the Exhibition installation the earth plates are 90 yd. from the clock itself. The primary battery thus arranged provides about 1 volt p.d. at the clock terminals and sets up a very small current through a many-turn winding on the "bob" of the pendulum. The motion of the latter reverses the direction of current flow at the end of each swing and thus enables the maintenance of its oscillations. The clock employed is of very simple and robust construction, and usually keeps correct time to within 1 minute in 12 months. It is not dear in initial cost, as compared with other high-class timepieces, and there is no reason why the clock should not run for years without attention providing the gears and contacts do not wear down.

Messrs. Dorman & Smith (59, 64),

Ordsal Electrical Works, Salford.

Photographs of some main generator control pillars and main switchboards, of which some 16 were supplied to the *Olympic* and *Titanic*—the largest steamships afloat—may be seen on this stand,

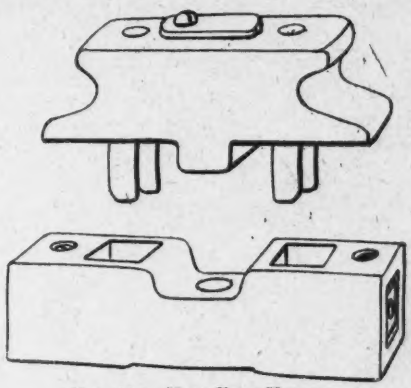


Fig. 220.—New Fuse-Holder.

as well as views of indicator pillars and voltmeter pillars. A new type of switch-fuse power boards, with bevelled tops, fitted with removable plates to facilitate wiring, is exhibited, as well as the

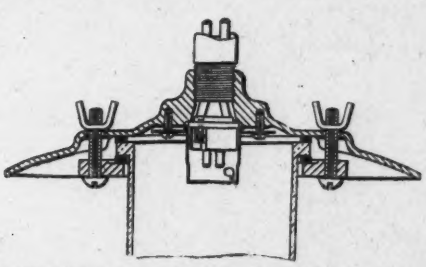


Fig. 221.—Section of Patent Easy Wiring Fitting.

firm's standard fittings for bulkhead lamps, lanterns, &c. A porcelain fuse holder designed to comply with the Home Office requirements, all the live metal parts being enclosed (fig. 220), and a new

Fig. 222.—Easy Wiring C.I. Well-glass Fitting.

fitting for easy wiring (fig. 222) are shown; it will be seen from the section of the latter (fig. 221), that the porcelain of the lamp-the holder is clamped tightly against the body of the shade, and conduit screws directly into the latter, making a watertight fitting.

Messrs. R. A. Lister & Co., Ltd. (11, 12),

Dursley, Glos.

This firm is making a special display of the "Bruston" patent automatic electric generating plants, which were fully described in our issue of July 14th last.

The generating plant is self-contained, consisting of engine, belt-driven dynamo, controller, &c., and a switch cabinet (in the small sizes) carries the switchboard and battery.

The exhibit includes a couple of these plants installed in a small engine room adjacent to a tastefully furnished apartment, which is equipped with electric light, and thus enables the firm to demonstrate the automatic features of the installation.

Messrs. A. P. Lundberg & Sons (90),

Pioneer Works, Liverpool Road, N.

No comprehensive reference to Messrs. Lundberg's exhibit can be attempted here; the number and ingenuity of their switch specialities have always been a source of wonder to us and others—and quite a good selection of these can be seen on the stand. We understand that Messrs. Lundberg's rate of output of new designs, improvements, &c., is as great as ever, and we had no difficulty in finding something new. Readers will be interested in a new pattern of 10-ampere metal-cased watertight push-and-pull switch (fig. 223) which has been supplied to the Admiralty. The box is of "Naval" brass, with lugs for fixing. Stuffing boxes are provided for the leads, the operating plunger passes through a similar box, and the screw-on cover has a soft metal packing ring. The inner end of the plunger is insulated by a porcelain reel from the contact parts of the switch. The most important feature of this accessory is its independent make and break, its action being quite unaffected by slow or uncertain operation of the plunger, or by the tightness of the packing around the latter. The special form of terminals, it will be noticed, allows of ease of wiring and security of connection.

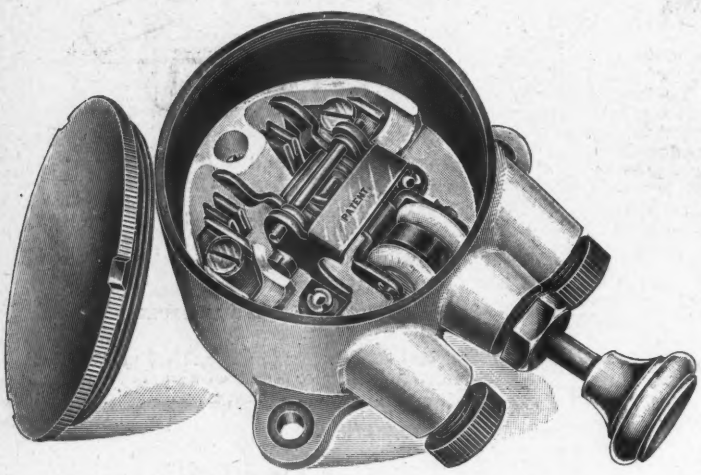


Fig. 223.—Watertight Push-and-Pull Switch.

A neat double-push type of flush switch, illustrated in fig. 224, is of interest. This shows a single-way type, but the same action can be applied to both the two-way and intermediate types as well. These switches are supplied in iron boxes.

We understand that several "Lektrik" plug connections for earthing, in line with Home Office requirements, are now available; and the fibre-disk, two and three-pin plugs for all kinds of sockets are now provided with extra insulating mica bushes and washers, an improvement which has been patented. In fig. 225 we illustrate an ingenious plug connection suitable for places where hand lamps are used, or where accumulators have to be charged; it will be noticed that one of the side pins in the plug cap catches in a hole in the spring-hinged cover, which thus prevents the plug from being accidentally withdrawn.

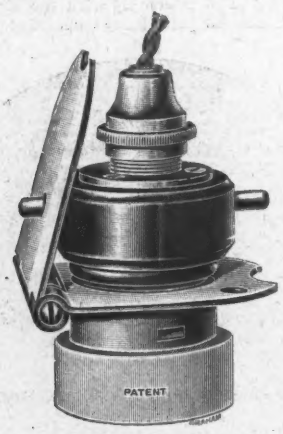


Fig. 225.—Safety Plug and Socket.

In connection with the above, mention may be made of the combination switch and plug, fig. 226, which, where a D.C. supply is available, enables one either to burn a lamp or charge an accumulator with the lamp in series through the plug connection.

This, of course, is a general feature of the Lundberg switch arrangements; you can do almost anything with them, if you ask Messrs. Lundberg what to use and how to use it.

Sir Joseph Causton & Sons, Ltd. (300),

Birkbeck Street Works, Bethnal Green, E.

This exhibit includes a most artistic and effective variety of advertising and display signs, ranging from small imitation flower signs to large polychrome disks and globes. A characteristic feature throughout is the uniform light distribution obtained from a single carbon-filament lamp (16 C.P. in the small signs and 25 C.P. in the larger equipments). The "flower" signs exhibited have ventilated covers (to obviate any risk of cracked glasses), high efficiency distributing back reflectors and very effective stained-glass work. We also notice a new screen design showing opaque lettering on a silvered background by daylight and translucent mono or polychrome lettering on an opaque background by light from the back lamp; here again the special reflector design gives very uniform illumination from a single lamp.

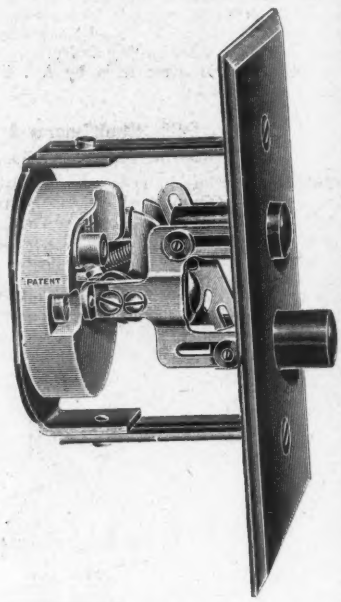


Fig. 224.—Double-Push Flush Switch.

The attention of every visitor, however, is riveted by the new polychrome signs and decorative effects. These are attractive by day and by night, and are equally applicable to every class of interior and exterior display. The effect produced is that of swirling streams of liquid or clouds of vapour in ever-changing soft and brilliant colours. The signs must be seen to be appreciated.

We understand that the whole effect is mechanically produced by the relative movement of a single carbon lamp (25 C.P.) and various colour plates used in conjunction with special reflectors and diffusing media. The moving parts are actuated by a spring-motor running six hours on a single wind; there is no limit to the variety of polychrome fittings which can be applied to the motor equipment, so that the sign may be simply a charming riot of colour or the same in conjunction with any flashing or permanent advertising or scenic effect. A wide range of signs and "attractions" is exhibited, and these we heartily commend to our readers' inspection.

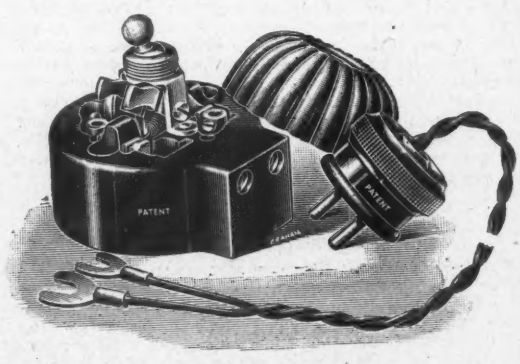


Fig. 226.—Combination Switch and Plug.

Messrs. G. M. Roddy & Co. (297),

8, *Leadenhall Street, E.C.*

These well-known factors are exhibiting an interesting selection of miscellaneous fittings and accessories, in addition to a range of Tantalum and "Mazda" lamps, "Holophane" and "Weatherproof" fittings for the same, and various electric radiators and convectors.

Messrs. H. R. Witting and K. and Th. Moller (325),

9, *Southampton Street, W.C.*

In the latest type of the Moller air filter—applicable to ventilating schemes or to the cleansing of air blown through electrical machinery for ventilating purposes—a number of independent "pockets" are employed in place of a continuous cloth (see fig. 227). A strong cotton material is used, with specially roughened surface; as fitted to the "pocket" frames it is nowhere in contact with metal, and no eyelet holes are required. The filter cloth can be easily and perfectly stretched over each frame, and each pocket

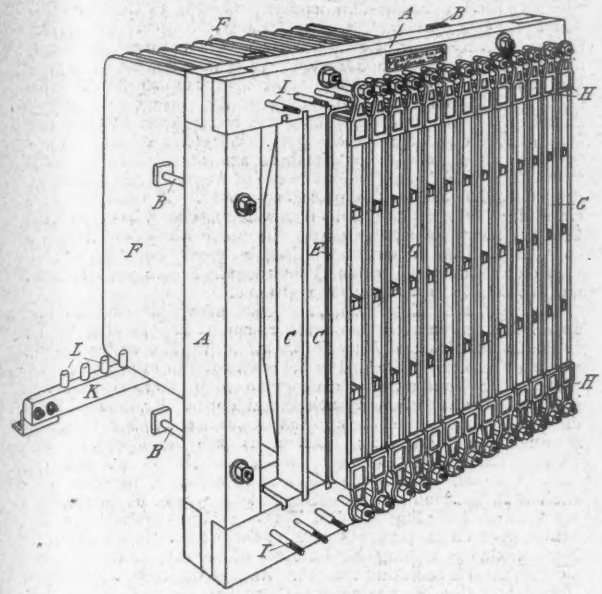


Fig. 227.

can be removed for cleaning (by benzine or, preferably, by a vacuum process), without at all interfering with the action of the filter as a whole. We are informed that 600 filters, of a total capacity exceeding six million cubic metres of air per hour, have already been supplied for use with turbo-generators; each standard "pocket" filters about 270 cb. ft. per min.

Side lines at this stand are various counting and recording movements by Roux & Co. and by K. Hardtmann.

Messrs. F. M. Russell & Co., Ltd. (320),

Junction Works, Willesden, N.W.

Besides its better known specialities such as the Follett Time Stamp, the Simplex Key Time Recorder, the Watchman's "Tell Tale" Recorder, and other time-recording instruments, this firm is exhibiting new or improved models of other apparatus of this class. The "Kosmoid" Signature Time Recorder is made in various patterns to suit different services, and avoids all possibility of error, wilful or accidental; the time of each employé's arrival and departure is shown against his own signature, so that only by forgery can the purpose of the machine be circumvented. The "Jurus" Lift Recorder charts the exact time and duration of every movement and stoppage of the cage, and is being widely used by London underground electric railways. A new Current and Brake Recorder, for use on electric railways and tramways, is now undergoing trial by the London, Brighton and South Coast electrified line, and we hope to publish a full description of it at a later date. The functions of the instrument are to record the distances travelled with and without current, and under braking respectively. These particulars are printed at the beginning and end of each journey on a loose driver's card; in conjunction with a bonus system, it is needless to say that the recorder brings about great economy in working. Other interesting instruments worthy of inspection are the "Jurus" Speed and Journey Recorder, applicable to any class of vehicle, and affording an indisputable record of its speed and distance performance, and the Ship Steerage Recorder, showing the time and duration of every rudder movement. Features of all the above recorders are their simplicity and durability.

Marconi's Wireless Telegraph Co., Ltd. (154, 246),

Watergate House, W.C.

This firm is exhibiting examples of its latest marine-type wireless telegraph equipment, in addition to an interesting selection of apparatus required for experimental and everyday work in radio-telegraphy. The Marconi Co.'s standard 1½-kw. ship station is still used on passenger liners of medium size, but whereas larger vessels have installed 3 or 5-kw. stations, there has lately grown up a wide demand for a smaller equipment suitable for small passenger boats, cargo vessels and destroyers. To meet this demand a ½-kw. station has been designed; the normal transmitting distance is 150 miles, but on favourable night trials messages have been dispatched as far as 500 miles from such an equipment. Visitors will notice that the ½-kw. set, unlike the 1½-kw. station, has no oil tanks for the transformer and condenser, and the amount of woodwork in the construction is reduced to an absolute minimum. The well-known magnetic detector is employed in all the ship stations, and in a very large number of land stations; some of the latter, however, are equipped with electrolytic or contact detectors.

Le Carbone (95),

17, *Water Lane, Great Tower Street, E.C.*

This exhibit is representative of the numerous carbon and other products associated with the Le Carbone, comprising dynamo and motor brushes in carbon, combined metal and carbon, gauze, anti-friction metal, &c., the Le Carbone pig-tail connection for brushes, carbon switch breaks, packing rings (for turbines), the Lacombe and Carbi primary cells, microphone carbons, &c.

We understand that the firm's carbon brushes are in use on the majority of British traction systems, and some of their "F" grade brushes on the Central London Railway have reached 35,000-50,000 miles' use, while some E 29 grade reached an average of 35,000 miles.

Messrs. Rose Bros. (328),

38, 39, *Beech Street, Barbican, E.C.*

A wide range of electrical accessories and novelties is shown at this stand. Special attention should be called to the "Comet" Schmidt dry battery; the three-cell type, for pocket flash lamps, &c., yields 0·25 ampere *continuously* for four hours—an excellent performance. The well-known "White Star" dry battery is supplied in various sizes suitable for ignition, bell and telephone work; the standard cell for bell work yields 12—15 amperes on short-circuit—an output indicative of very low internal resistance. The firm's "R.B." accumulators, of various sizes and patterns, are suitable for ignition and small lighting loads. Visitors should inspect the very wide range of pocket lamps and torches exhibited. We understand that Messrs. Rose Bros. have several important contracts pending for the further supply of portable accumulator lamp sets to police officers in various towns.

This firm holds the agency for the Compagnie F.A.C.'s portable and switchboard voltmeters and ammeters and combination voltmeters and centre-zero ammeters for charging sets and motor-car work, &c. The attention of motorists may be called to a novel design of car-lighting dynamo provided with a gyroscopic cut-out, which switches an auxiliary secondary battery in or out of circuit when the dynamo speed falls below or exceeds 1,500 r.p.m. respectively. We notice an exceptional variety of miniature metallic-filament lamps (¼—1 ampere), bells and bell switches, medical coils and massage sets, &c.

The Ronald Manufacturing Co. (248).

This firm makes a speciality of small accumulators and various accessory apparatus employing the latter (*e.g.*, portable hand lamps and miscellaneous lighting sets and accessories). A new type of lattice grid is employed in the construction of the plates, which are specially light and practically incapable of buckling; a special paste composition is forced into the grids by hydraulic pressure. The terminal lugs are burnt on to the plates, and a non-creeping amalgam is used in their stem; this appears to be highly effective. The polarity of the terminals is permanently indicated by coloured fibre washers. In the hand lamp sets sufficient acid is retained by a glass wool filling between the plates; these cells are only 10 per cent. less efficient than the "liquid" type, and are naturally non-spillable. We understand that the Ronald Co. has made probably the largest celluloid accumulator extant for exhibition work: unfortunately this cannot be shown at the present Exhibition, as it is charged. The company has also achieved some very striking and effective repairs on deteriorated cells of other makes.

Ship Carbons, Ltd. (58, 65),

67, *Aldersgate Street, E.C.*

The company specialises in carbon goods, and the well-known "Shipcarbon" brand is familiar to most of our readers.

The exhibit consists of a tasteful display of flame, open and enclosed arc carbons, brush carbons, coppered and plain, together with cinematograph, battery and other carbons for all purposes.

The Electric Home at Olympia.

In our reference last week to the Home in the gallery, we said that the supply for all purposes was taken from the small generating set and battery installed at the kitchen end. This is not the case. The lighting of the Home, and that alone, is done from this small plant, the general Olympia supply being drawn upon for the laundry, cooking and other such like purposes.

Exhibition Lectures.—To-day, Friday, at 8 p.m., Mr. R. Borlase Matthews will lecture on the Therol system of cooking, at the Electric Supply Companies' stand at the Olympia Electrical Exhibition.

CONTRACTS CLOSED.

(*Continued from page* 606.)

Wimbledon.—The Watch Committee reports having had under consideration the report of Mr. James Swinburne as to the system of fire-alarms most suitable for installation in the borough, and has come to the conclusion that, in accordance with his recommendation, the Siemens system of fire-alarms should be adopted for installation, subject to (1) Messrs. Siemens Bros. and Co., Ltd., agreeing to substitute secondary batteries for Daniell batteries without extra cost, and (2) a satisfactory arrangement being made with the Post Office London Telephone Service for the renting of their wires and the maintenance of the system.

Wrexham.—The T.C. has accepted the tender of the Lancashire Dynamo Co., Ltd., for a motor-driven booster, at £120; that of Messrs. Whipp & Bourne for switchgear, at £84; that of Messrs. Hall & Pickles for 13 steel joists for the battery floor, at 7s. 9d. per cwt. for joints, and 8s. 6d. each end for cranking and drilling; that of the British Reinforced Concrete Engineering Co. for electrically-welded fabric for the concrete floor; that of Messrs. Willans & Robinson for an automatic expansion gear for No. 3 engine, at £105; and that of the Tudor Accumulator Co., Ltd., for a traction battery, at £475, and maintenance for 10 years at annual payments ranging from £42 to £30.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 13th. At 6.30 p.m. Visit to "The Model Engineer" Exhibition at the Royal Horticultural Hall, Westminster.

Northampton Institute Engineering Society.—Friday, October 13th. At 5.45 p.m. Presidential address by Dr. R. Mullineux Walmsley.

Faraday Society.—Tuesday, October 17th. At 8 p.m. At the Institution of Electrical Engineers. Adjourned discussion on "The 'Paragon' Electric Furnace and Recent Developments in Metallurgy," by Mr. J. Hårdén; "Progress in the Electrometallurgy of Iron and Steel," by Mr. D. F. Campbell; and "The Hering 'Pinch Effect' Furnace," by Mr. E. Kilburn Scott.

Olympia Electrical Exhibition.—Saturday, October 21st. Closing day.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following orders are issued:—

Drills for efficiency (1911-1912) will commence at Headquarters on Thursday, November 2nd, 1911, and Headquarters will be open as stated below from that date:—

Daily (except Saturdays), 10 a.m. to 10 p.m.
Saturdays (unless otherwise ordered), 10 a.m. to 12 noon.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Electricity in the Home.—As a souvenir of the Olympia Electrical Exhibition, the General Electric Co., Ltd., are presenting visitors with a very attractively got-up brochure, entitled "The Magic Wand of Science," in which they treat of the application of electricity in every-day life in quite an interesting way, the pictures being life-like representations of ironing by electricity, cooking by electricity, electricity in the breakfast and drawing-rooms, the vacuum cleaner at work, electricity in the bedroom and the nursery. At the end of the pamphlet (24 pages) is a simple, straightforward list of prices of electrical domestic appliances. It is intended that the brochure shall reach the public through the trade and central stations, as well as at the Exhibition, and quantities can be furnished to central station authorities who will undertake to distribute them.

Electrical Imports and Exports.—The official returns regarding foreign trade during the month of September show that the electrical goods imported were £125,428, or £53,532 less than in September, 1910, and machinery was £426,979, an increase of £82,331. In exports electrical goods figure at £209,332, a decrease of £222,357, as compared with September, 1910. The reason of this decrease is obvious when we remember that in the 1910 figure for the month, one special item of telegraph cable, &c., sent to the U.S.A., Philippines, Porto Rico, and Cuba was valued at £230,654. Machinery exported shows a fall of £350,799 for the month.

Wireless Signals from Lighthouses.—For the direction of ships by wireless telegraphy, Major von Salviati proposes, in cases of fog, to complete the indications given by the lighthouses on the Ahrenhold system by means of wireless signals. A signal will be made with each extinction of the light by the same clockwork which controls the former. The cost of this innovation is small, as are the working costs, for the giving of a short signal every five or ten minutes is all that is needed.—*E.T.Z.*

Copper.—Messrs. Merton's statistical circulars for mid-September and for the 30th of the same month give, as usual, a quantity of interesting details on the state of supplies of this metal. At mid-month the visible supplies were 68,177 tons, a drop of 25,784 tons as compared with last September, but an increase of 1,263 tons over the return for the end of August, 1911. This had, however, fallen by the end of September to 67,340 tons, the increase on the month being therefore only 326 tons. For mid-month the supplies to English ports from North America are average, from Spain and Portugal decidedly low, from Chile rather over the average, and from Australia just under it. Deliveries at 17,268 would indicate a rather dull market. Coming to the figures for September 30th, we find supplies from North America low, from Spain and Portugal practically just double the mid-monthly return, and therefore low, from Chile low, and from Australia also a good deal under the average. The total deliveries, at 32,943 tons, show a fulfilment of the indications of the mid-monthly return. American supplies are still falling off, being down 1,919 tons on July, at 59,571 tons for end of August. Rotterdam stocks are down 400 tons since August, but Hamburg are estimated to be up 300 tons. The world's supply for the end of August is 126,485 tons, a drop of 3,030 tons on the preceding month. The average drop since May, 1910, when 178,593 tons were registered, has been 3,400 tons per month, a rate at which the present supplies will take a considerable time to work off. English stocks (in port) fell 550 tons on the month (September) and those in French ports 74 tons; and afloat 1,050 tons more were registered.

The slow, but fairly steady, reduction of visible supplies has, apparently, encouraged the trust rumours, &c., judging by an article in the *Financial News* of October 10th. The writer therein says that London is indicated as the centre of the combination, the States being found unsuitable under an administration which has already instituted actions against several Trusts. Mr. Edmund Louis de Bestry, vice-president of the American Mining Congress, is quoted as indicating London as the headquarters, and Baron Rothschild as the president. (It is pointed out that the use of Baron Rothschild's name in this connection is, no doubt, unauthorised.) This would, of course, be a try towards including the Rio Tinto in the organisation. The article goes on to point out that, at the present time, with other large producers coming in, the effect of the surplus on American copper shares is becoming marked. Arizona Commercial, Shannon, Boston and Corbin are quoted as down, and Colorado, Sioux Consolidated and Uncle Sam as dropping. One can hardly reconcile this with Trust rumours.

Electric Towage for the Panama Canal.—The Isthmian Canal Commission, Washington, D.C., has advertised for proposals for furnishing one electric towing locomotive, complete, for the Gatun Locks, and 39 electric towing locomotives for towing ships through the locks of the Panama Canal. Four locomotives will be required to tow a vessel of moderate size—two ahead, one on either wall, towing, and two behind, trailing, to keep the vessel in the middle of the lock. The towing speed is 2 miles per hour. The electrical equipment of each locomotive is to consist of two traction motors and controllers. There are also to be a motor and controllers for operating a windlass for hauling in or paying out the tow-line under load, and a high-speed, motor-driven attachment for coiling the tow-line when out of service. The motors are to be three-phase, 25-cycle, 220-volt induction motors of the railway or mill type, totally enclosed and moisture-proof.—*Electrical World.*

Scott's Old Boys.—This informal Society held its fifth reunion at Olympia on Saturday last, Mr. C. N. Russell presiding at the dinner. Although it had been suggested that visitors should be invited upon this occasion, the old traditions were maintained, and only men who were in the Acton works in the eighties were present. The function was marked by a great display of enthusiasm. There are still a few of the old boys who are not in touch with the Society, and these are requested to communicate with Mr. H. Marryat, of 28, Hatton Garden.

The Electro-Harmonic Society.—The artists for next Friday's concert are as follows:—Vocalists—Mr. John Bardsley (tenor), and Mr. Graham Smart (bass-baritone); violoncello, Mr. W. H. Squire; cornet solos, Master Shakespeare; art humourist, Mr. Ernest Mills; conjuror, Mr. Herbert J. Collings: humorous recitals and short stories, Mr. Charles Wreford; sensation novels, Mr. Frederick Upton; sketches at the piano, Mr. Harrison Hill. Mr. R. Kaye Gray will be the chairman. The list of dates for the season's concerts is given on page 591 of this issue.

Sewer Gas as a Motive Power.—Experiments are being carried out at the Parramatta sewage works on the utilisation of sewer gas for motive power. Gas is taken from the septic tanks to a 2-H.P. gas engine coupled to a dynamo and used for illuminating the grounds. The quantity of gas generated per cb. ft. of sewage has not yet been ascertained with any degree of certainty, but there is no doubt that it is much superior to coal gas in point of cleanliness. Tests are also being made to ascertain the average calorific value of the gas. There seem to be commercial possibilities in the scheme and undoubted advantages from the health point of view, as it is obviously better to consume the gas than to allow it to escape into the atmosphere as is done at present.

Fatality.—A fatal accident occurred on Monday afternoon at Makin's paper mills, Disley, near Stockport. H. Viggars (18) was employed in fitting up electric light cables, and was threading one of the cables through the wall; it is surmised that the wire was caught by the rotating machinery, and Viggars was dragged with the cable. Hearing a cry a man named

Simpson stopped the engine, and rushing to the spot found the deceased's foot, leg and arm torn off, and his head terribly mutilated. He died in a few minutes. Deceased was employed by a Manchester firm of electricians.

A Wireless Ship Compass.—A wireless compass is reported to have been devised by MM. Bellini and Tosi, Italian officers, and is shortly to be tested as to its ability to indicate the exact position of a ship travelling in time of fog. For this purpose special wireless signals will be transmitted from various parts of the French coast to ships equipped with the apparatus. Each of the signals from the different stations will be arranged in a different tune; and as the different tunes correspond with the letters of the alphabet, it is claimed that it is impossible to mistake the signals from one station for those from another. When set to receive a wireless signal the compass indicates automatically by a pointer the direction from which the signal emanates, so that the man at the compass is able, notwithstanding the thickest fog, to determine exactly the direction and situation of the various stations, and is consequently able to calculate where the ship is situated.

Appointments Vacant.—Assistant telegraph superintendent for the Great Indian Peninsula Railway (Rs. 500 per month); mechanical superintendent for the West Ham Corporation Electricity Works; station engineer and engineman for the Bradford Technical College extension; mains superintendent for the Perth Corporation Electricity Department; switchboard attendant for the Erith Council Electricity Department; assistant station superintendent for the Yorkshire Electric Power Co. (£156). See our advertisement pages to-day.

Institution and Lecture Notes.—Battersea Polytechnic.—The first of a special course of lectures on "Illuminating Engineering," by specialists, is to be delivered on Tuesday next, October 17th.

The Association of Engineers-in-Charge.—On Wednesday evening at St. Bride's Institute, E.C., Mr. W. H. Maw delivered his presidential address to the members of this Association.

Inquiry.—A correspondent inquires for the maker of the Sinclair insulator, labelled "The Only Way, G. & G."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Winchester T.C. has appointed Mr. R. Ayton as resident operating engineer at the electricity works.

On September 29th, at the Ilford Council Electricity Works, Mr. John A. Vice, engineer-in-charge, was presented by the staff with a silver cigarette case on his leaving to take up a similar position with the Lancashire Electric Power Co. at their Radcliffe power house.

Mr. Robert W. Willis, of Perth, has been appointed chief assistant electrical engineer to the Swindon Corporation.

The salary of Mr. H. P. Stokes, borough electrical engineer and tramways manager of the Ilkeston Corporation Tramways, has been increased by £15 per annum.

Mr. Mackenzie, the mechanical superintendent at West Ham generating station, has sent in his resignation.

In submitting the accounts of the electricity undertaking, the Battersea Electricity Committee drew the attention of the Council to the very satisfactory progress made during the year 1910-11 (the net profit advanced from £1,206 to £3,500), which it was of opinion was largely due to the services rendered by Mr. F. A. Bond, the electrical engineer. The Committee unanimously recommended that his salary be increased from £600 to £650 per annum, and this recommendation has been adopted by the Council.

Mr. Alex. C. Cramb, borough electrical engineer of Croydon, was married, on the 5th inst., to Miss Maud M. Hillier, daughter of Alderman T. Hillier, a member of the Croydon Corporation since 1883. The ceremony was attended by the Mayor and Mayoress (Alderman and Mrs. Trumble), Alderman D. B. Miller (chairman of the Lighting and Electricity Committee), the town clerk and many members of the Council and chief officials. A few days previously, Mr. Cramb received, at the hands of Mr. Burr (deputy electrical engineer), an inscribed silver salver from the staff of the electricity works. The Lighting and Electricity Committee presented a silver tea service, and the chief Corporation offices a case of table cutlery.

Mr. Lionel Andrew has resigned the position of chief assistant electrical engineer to the Stoke Newington B.C., which he has occupied for the past five years, in order to take up the post of managing director of the Coupé Co., London, who are supplying London with 6d. a mile taxicabs for private hire. Prior to his Stoke Newington appointment, Mr. Andrew was for two years shift engineer at the Fulham electricity works.

General.—The Winchester T.C. has appointed Messrs. Merz & McLellan, of Westminster, as consulting engineers to the electricity undertaking for five years.

The secretaryship of the Junior Institution of Engineers, rendered vacant by the resignation of Mr. Walter T. Dunn, after so lengthy a period of splendid service, has been filled by the appointment of Mr. A. Clifford Swales, engineering assistant to the city engineer of Leeds. Mr. Swales served two years of his articles under the late Mr. Thos. Hewson, city and waterworks engineer, of Leeds, completing his term under Mr. W. T. Lancashire, city engineer of Leeds. Apart from his experience in the city office, Mr. Swales was for some time engaged on the new Leighton Reservoir for the Leeds Corporation, at Masham, the holding capacity of which will be 1,136,000,000 gallons. He was for four years honorary secretary of the Yorkshire Association of the Institution of Civil Engineers, and was last year awarded a "Miller Prize" by the Institution of Civil Engineers for his thesis on "Cement and Concrete."

Mr. A. B. Mallinson has severed his connection with Messrs. Mather & Platt, Ltd., and joined the firm of Mallinson and Eckersley, Ltd., at Albert Saw Mills, Worsley Street, New Bailey Street, Salford. It is his intention also to continue (in a consulting capacity) his engineering work, making a speciality of the application of electricity to works of all descriptions, particularly textile mills, paper mills and collieries. Mr. Mallinson's connection with Messrs. Mather & Platt, Ltd., where he was joint manager of the electrical department, extended over a period of 14 years.

Mr. R. Borlase Matthews, Wh.Ex., informs us that he is relinquishing his present work as a consulting engineer, to become manager to Messrs. Ozonair, Ltd., 96, Victoria Street, Westminster, S.W.

Mr. Albert Vaux, of Clyde Engineering Works, Buitengracht Street, Cape Town, left on Saturday last by the *Edinburgh Castle* on his return to the Cape.

NEW COMPANIES REGISTERED.

Patent Brake Blocks, Ltd. (117,962).—This company was registered on October 6th, with a capital of £10,000 in £1 shares, to take over the business of Jones & Co., engineers, Padeswood, near Mold, and to purchase and place on the market a speciality in railway and tramway brake blocks, cast-iron chilled wheels, &c. The subscribers (with one share each) are:—G. C. Taylor, Ravenswear, Helsby, Chester, engineer; J. T. Morgans, The Mount, Mold, Flint, tinplate manufacturer; J. Owens, 20, Old Bank Buildings, Chester, accountant; W. Taylor, Padeswood, Flint, engineer; J. W. Taylor, Padeswood, Flint, engineer; C. O. Taylor, Padeswood, Flint, engineer; G. Beckett, 4, Old Wrexham Road, Chester, clerk. Minimum cash subscription £2,500. The number of directors is not to be less than three or more than five; the first are G. C. Taylor, J. T. Morgans and J. Owens; qualification, £200. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

Italian Concessions Syndicate, Ltd. (117,882).—This company was registered on October 2nd, with a capital of £5,000 in 4,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each, to acquire and deal in options, concessions or rights in connection with railways, tramways, electric power, land, buildings, factories, workshops and any real or personal property in Italy or elsewhere, and to adopt an agreement with Michael Palmer & Co., Ltd. The subscribers (with one preference share each) are:—J. A. Moir, "Craigleith," Hadley Road, New Barnet, secretary; F. A. Wallace, 16, Finsbury Road, Wood Green, N., accountant. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Registered office, 3, Warwick Court, Holborn, W.C.

Scholey & Co., Ltd. (117,945).—This company was registered on October 5th, with a capital of £21,000 in 20,000 cumulative preference shares of £1 each and 20,000 ordinary shares of 1s. each, to carry on the business of manufacturers of and dealers in railway and tramway appliances, rolling stock, engines and machinery of all kinds, founders, electricians, railway and tramway contractors, &c., and to adopt an agreement with H. Scholey. The subscribers (with one preference share each) are:—F. S. Clark, 85, Gresham Street, E.C., solicitor; Catherine George, 85, Gresham Street, E.C., secretary. Private company. Table "A" mainly applies. Registered office, 151, Queen Victoria Street, E.C.

CITY NOTES.

The B.E.T. Proposed Rearrangement of Capital.

It is now announced that an extraordinary general meeting of the B.E.T. Co. will be held on the 17th inst. for the purpose of considering the scheme which was fully described in our issue of August 11th, as well as a memorandum by Mr. Garcke, which has been issued to the shareholders, commenting upon the alleged equity of the capital reconstruction scheme in general, and upon the disparity of profits in relation to the paid-up capital, perhaps, in particular. He attributes the latter to inadequate fares; but such an attribution or declaration is by no means a new feature of Mr. Garcke's views on the subject. Tramway service is cheap; but that is not the real reason of the present position of the B.E.T.

The transcending question of depreciation of assets is a matter which is usually inseparable from any scheme of rearrangement of capital. That there has been a very large depreciation of the paper assets of the B.E.T. seems to be undoubted; but Mr. Garcke states that the problem which arises therefrom can be discussed

better after the shareholders have dealt with the scheme under review, which is an assertion without reason, advanced with the hope of giving life to the somewhat ponderous and complicated scheme which has been formulated, and in which the shareholders are requested to concur at the meeting convened for the 17th inst.

This question of the values of assets should be carefully considered from every aspect before any scheme is submitted to the shareholders, and Mr. Garcke would, we think, be well advised to take a representative number of the preference and ordinary shareholders into the confidence of the directors before proceeding further with a scheme which has merited much dissatisfaction.

In our opinion, if the scheme be passed, the deferred shares are not likely to exceed scrap paper price, whilst the preferred ordinaries must wait long and patiently for the appearance of any sign of practical value.

Since writing the foregoing, our attention has been directed to a circular which has been issued to the shareholders of the B.E.T., signed on behalf of the Anglo-American Debenture Corporation, the Gas, Water and General Investment Trust, the Municipal Trust Co. and others, protesting against the adoption of Mr. Garcke's scheme. This circular seems to confirm the views to which we have just given expression, as well as those enunciated in our article on August 11th.

British Thomson-Houston Co., Ltd.

The directors' report covering a period of 12 months from April 1st, 1910, to March 31st, 1911, reads as follows :—

Works at Rugby.—The buildings and machinery of the company have been maintained in first-class condition during the year. In last year's report it was stated that an extension to the main factory was then approaching completion, this extension being necessary to take care of the increase in the turbine business of the company ; also that another building was being enlarged. Both of these improvements have been completed during the year, and further extensions are under construction, the most important being a four-floor building to be utilised as a winding department, and a three-floor extension to the iron foundry. Other important extensions are now being considered in connection with the growth of the company's business. Notwithstanding the additional facilities the shops are full of work, and this should make a marked improvement in the company's progress. Up to November last the orders secured were below in value those secured during the corresponding period in the previous financial year, but soon thereafter they began to increase, and at the closing of the books on March 31st were largely in excess of those booked during the previous year, though this came too late to affect the present balance-sheet. This satisfactory rate of increase has continued during the current year.

Curtis Steam Turbines.—The turbine business of the company continues to show satisfactory results, and the largest number of turbines that the company has ever had on order are now in course of construction.

Metallic-Filament Lamps.—During the year ending March 31st the company expended a large amount in advertising the "Mazda" lamp. This has been justified by the rapid expansion of lamp sales. Here again, however, the expansion came too late to affect the present balance-sheet, although the expenditure was made during the financial year under review. As has been announced in the Press, a marked and most important advance has been made in lamp manufacture ; the company has secured the patents and processes for making pure drawn tungsten wire which is used for filaments, and replaces the old pressed tungsten filaments ; the new form of lamp being stronger during all stages of its life than any other tungsten lamp manufactured. In order to take care of the increasing lamp business, the company has acquired premises in Upper Thames Street (adjacent to Queen Street) and near the present offices, which new premises will be known as "Mazda House," and devoted to the sale of lamps and wiring supplies. At Manchester a similar step has been taken, with the same object in view.

Debenture Redemption.—Under the terms of the trust deed securing the issue of the company's debentures, the company had to pay to the trustees on February 28th last £3,339 to be applied by them in purchasing debentures in the market. Prior to the closing of the books, debentures of the par value of £3,339 were purchased, making the total par value of debentures retired to date £13,760. The directors have followed their usual practice in making reserves to cover risks in connection with bad debts, depreciation of shares held by the company, and other contingencies.

The balance-sheet shows a profit of £6,374 as the result of the year's working, after paying interest on debentures and loans, which the directors recommend should be appropriated as shown in the profit and loss account and balance-sheet. To depreciation of office furniture and store-room equipments, £628 ; to depreciation of apparatus, meters, supplies, &c., £5,343, leaving a balance of £403, which together with the previous year's balance makes a total amount to be carried forward of £3,002. The directors have decided hereafter, beginning with the current year, to close the books on December 31st instead of March 31st, so that the next balance-sheet will cover the company's operations for a period of nine months only. The retiring directors are Messrs. G. Franklin, J. F. Nauheim and E. Thurnauer, who, being eligible, offer themselves for re-election. The directors have thought it in the best interests of the company to elect Messrs. W. C. Lusk, manager of the company's export department, and H. N. Sporborg, chief engineer at the Rugby works, to seats on the board, and the shareholders will be asked to ratify their election.

Willans & Robinson, Ltd.

The half-yearly meeting was held on Tuesday at the Cannon Street Hotel, E.C., Mr. J. C. Peache, M.I.C.E., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 577), said he wished first to refer to the recent lawsuit, which had been concluded at such a heavy cost to the company. At the time of the meeting in April last, the case was still in progress, and although it was briefly alluded to at that and at previous meetings, it would have been injudicious to enter into a discussion on the merits of the case, and, indeed, the law imposed strict limits as to the comments on a case *sub judice*. Those reasons for reticence were now removed, and the shareholders were entitled to receive a full explanation of the causes leading up to this heavy loss. The case arose out of contracts carried out by the Queen's Ferry works during the years 1907-8. A heavy claim for damages was made on account of alleged defective work. Repeated efforts were made to effect a settlement, but on each occasion the claims put forward were so much in excess of the merits of the case, that no reasonable settlement could be arrived at. When Mr. Mark Robinson, owing to ill-health, had suddenly to resign the chairmanship of the company in April, 1909, there were left outstanding three cases of dispute, in each of which legal proceedings against the company were pending. These he (the chairman) had to deal with, amongst a mass of other work, and though he succeeded in effecting a settlement of two out of three of these cases, both of which were of quite as serious a character as the case which, unfortunately, went to trial, all his efforts to arrive at a reasonable settlement of the latter case were unavailing. So lately as last September Mr. Anderson and himself made a final attempt to settle this case, and on that occasion offered exactly double the sum their legal advisers fixed as the limit of what it was wise to offer. Even then there was a hopelessly wide gap between the sum offered by them and that which the other side were willing to accept. It was easy to be wise after the event, and to see now that it would have been better to have paid the full sum demanded rather than let the case continue. That course, however, did not appear justifiable at the time, and in allowing the case to go on the board were acting in accordance with the unhesitating advice of their legal advisers. The whole of the £19,656 shown as outstanding at June 30th had since that date been paid, and, so far, it had not been found necessary to exercise the borrowing powers recently entrusted to the directors. There were certain features about this matter that the shareholders would do well to bear in mind. In the first place, it was not the outcome of any recent half-year, nor was it the outcome of the Rugby business. It had now been completely paid for and settled, and with it, the liabilities arising out of the Queen's Ferry business were at an end. The history of the company since 1904 had been marked by an almost continuous clearing off of old liabilities. That chapter was now closed, and even if at the present moment, there were no very evident signs of returning prosperity, yet the Rugby business at any rate now stood on its own merits. The Queen's Ferry works were still standing unoccupied and unsold. There were still several parties who had the purchase of these works under consideration, but he regretted there was nothing of a definite nature to report. Since the close of the half-year, the Thames Ditton works had been sold. The sum realised for them was less than that at which they stood in the balance-sheet. This was largely due to the great depreciation which had taken place in industrial property in this country in recent years, but it was considered advisable to accept the opportunity of effecting a sale rather than let it pass. Passing to the consideration of the result of the half-year's working at Rugby, the directors regretted that they had to report a loss for the half-year of £7,692. It was due entirely to the continued low scale of prices prevailing in the class of business in which the company was concerned. The general volume of such business was insufficient to fully occupy the whole of the manufacturers, and consequently there continued to be keen competition, and an unremunerative level of prices. Under Mr. Davenport's *régime*, some further economies had been effected. The full result of these was not shown in the figures for the past half-year, but would materialise in the accounts for subsequent half-years. The study of economy would continue to have the close attention of the board, but it would be misleading to suggest that any considerable further savings could be made. Orders must be obtained, and the work must be properly executed, and to achieve these objects, it was essential that a sufficient and highly-trained staff be maintained ; while rates, taxes, insurance and other items of that nature had a constant tendency to increase. It was to the furthering of the company's business that the energies of the managing director and staff were chiefly directed. Taking some of the principal figures on the balance-sheet on the asset side, it would be seen that substantial amounts had been written off development account and Diesel engine suspense account, and both of these items stood at materially lower figures than for the previous half-year. Debtor balances (£91,948) stood at much the same figure as for the previous half-year. The large amount of the outstanding debts was frequently the subject of comment from shareholders. As explained on several previous occasions, the business of the company lay largely with municipal and other public bodies, whose custom was to spread payments over some 12

months after delivery. Nearly the whole of the items composing this sum of £91,948 were for goods supplied to sound and reliable concerns of this description. The total of cash in hand and investments, which should be considered together, showed no change from the previous six months' accounts. On the liability side of the balance-sheet the amount due to creditors showed an increase. This was almost entirely accounted for by the indebtedness regarding the Queen's Ferry lawsuit not discharged at June 30th, but since that date fully paid for. In considering this loss of between £7,000 and £8,000, it should be borne in mind that it was the practice of the company to write off depreciation against the profit and loss account in addition to charging a further considerable sum for somewhat similar items direct against cost of production, and therefore not separately shown on the profit and loss account. The loss shown, therefore, was to a great extent a book loss, and only to a small extent an actual cash loss, and although unsatisfactory, was not of a nature to make any serious drain on the assets of the company. The loss shown was less than that of either of the previous three half-years, and although there was no very evident sign of returning prosperity, yet there was some reason to hope that the corner had at last been turned, and progress in future might not be downward but upward.

Mr. F. R. Davenport, the managing director, in seconding the resolution, said he regretted to say that the infliction of low prices in their particular trades remained as severe as ever, due primarily, of course, to the usual laws of supply and demand, and it was hard to see any early improvement in that quarter. To illustrate this, he might say that an order was recently placed at about £4,000 for plant similar to what some three years ago they obtained £9,000 for, a market difference of over 50 per cent. Financially speaking, the times they had been passing through had naturally been anxious ones, but it was certainly gratifying that notwithstanding the heavy drains on their resources, due to trouble of past days, they had never yet had to overdraw their banking account, or have recourse to those borrowing powers which the shareholders sanctioned shortly after he joined the board, and which latter served as a good cash reserve. As one or two of their principal shareholders had well said at previous meetings, it was fruitless belittling one's enterprise at a time like this, and contrary to the true interests of the company. He would like to endorse this, and remind shareholders that tempting as it was to all of them to criticise past results, what they wanted, both as their fellow shareholders and directors, was the cordial support of their efforts to bring the concern into smoother water again. Signs were not wanting that even among their rival competitors a spirit of friendly co-operation existed, and he was not without hope that results beneficial to all concerned in this branch of engineering might yet mature. It seemed fitting also to make a passing reference to the prevailing labour unrest from which they at Rugby had not been entirely free. These threatened strikes in their own and kindred trades were far-reaching in their effect, and reacted inevitably on the workers themselves, for the simple reason that they not only delayed productive work, but operated against the spread of capital in the shape of fresh orders. This would appeal to them as shareholders, and, he hoped, would be better understood by the workers themselves as time went on. The ground was now much cleared for their future efforts, since, as the chairman had told them, they were at last rid of the many legal worries and embarrassments that had hung about the company's path. They had at the present time in hand their full share of what business was available, and that from the best class of client, which indicated that the work they attempted to accomplish was both appreciated and trustworthy. Every possible economy, both in production and organisation, continued to be sought after, and these should slowly but surely have good effect. Their business friends and clients were entrusting them with large and important work, and they felt confident that they could justify their doing so. As an indication of their confidence, he might say that their orders during the last three months showed a distinctly improving tendency.

The report was adopted.

Mr. Dean proposed a vote of thanks to the chairman, directors and staff.

Col. Plunkett, in seconding the vote, said he thought it ought to be put on record that that was the first time for some years that the report had been adopted unanimously and without any criticism. He thought from what the chairman and Mr. Davenport had told them that it was evident the company had got over the worst of its difficulties, and that although the rise at present was small and slow, it seemed to be sure, and it gave them every justification for looking forward to more prosperous times.

The vote was carried with acclamation, and acknowledged by the chairman.

German Electrical Companies.

The Berlin Elektromobil Droshken Gesellschaft (Electric Cab Co.), which decided to go into liquidation some time ago, reports that as the creditors have agreed to a reduction of £94,000 in the amount of their claims, the creditors' accounts now stand at only £12,000. At the recent meeting it was stated that it had been very difficult to ascertain the value of the assets, including landed estate in Halensee, buildings in Chausseestrasse, fleet of cabs, batteries, &c. For weeks it had not been possible to obtain a single offer. The circle of interested parties was very small, and the few persons concerned sought to secure for themselves the most advantageous prices by causing delays as long as possible. An agreement had been reached with all the creditors, and the liquidators express the hope that the liquidation will be brought to an end within a year.

The liquidator of the E. H. Geist Elektrizitats Gesellschaft, of Cologne-Zolestock, at the recent general meeting, announced that since the end of June the banking credit had increased, and the old banking debt had been reduced, thus showing that the situation had considerably improved. It had not been possible to sell the works in operation, and it was not to be assumed that success would be obtained in that direction. If the works were stopped the company would have no receipts, but would probably have large expenses for improvements, interest charges, increasing charges for redemption of loan, &c. An offer had been made to take over the works at a rental for a year certain, and the meeting authorised th liquidator to enter into an agreement for the purpose.

The report of the directors of the Kabelwerk Ryeydt, which deals with the financial year ended with June 30th, 1911, states that in general the company was not sufficiently employed. The sale prices for conducting material remained depressed, more so than the fall in raw materials, whilst at the same time, the large customers continued to hold back in the placing of orders. The accounts show profits of £39,600 on manufacturing, as compared with £38,800 in 1909-10. After meeting general expenses and providing £11,000 for depreciation, as against £10,000 in the preceding year, the balance-sheet exhibits a loss of £1,400, as contrasted with profits of £530 in 1909-10, on an ordinary share capital of £250,000. It is, therefore, again impossible to pay any dividend. The report adds that employment is normal at present, and by means of improvements in equipment a favourable result is expected for the current year.

Llanelly Electric Lighting and Traction Co., Ltd.

The fourth annual meeting took place on September 25th at 22A, Cannon Street, E.C., Mr. A. R. Holland presiding. The profit and loss account showed a credit balance of £57, which it was proposed to carry forward. The capital had been increased during the year to provide for improvements. The directors felt justified in paying an interim dividend on the preference shares for the half-year to June 30th. An issue of £50,000 5 per cent. debentures had been made in August, and in order to provide for increasing the plant at the power station they recommended that the nominal capital of the company be increased.

The Chairman said that the promise of success had been more than fulfilled. He attributed this fortunate condition to the skill and ability shown by the contractors and managers, Messrs. Balfour, Beatty & Co., Ltd. The whole of the streets of Llanelly were entirely lighted by electricity several days before the time provided for in the agreement, namely, the end of December last. The present machinery at the power station was already overloaded. Though an adequate amount of machinery had been provided, the growth had been so rapid that the directors thought it their duty to consider the extension of the plant.

At an extraordinary general meeting subsequently held it was decided to increase the capital by further 15,000 preference shares and 15,000 ordinary shares.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

British Columbia Electric Railway Co., Ltd.—Further issue of £600,000 4½ per cent. perpetual consolidated debenture stock.

The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 40,370 5 per cent. cumulative preference shares of £5 each, fully-paid (Nos. 120,001 to 160,370).

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 7,761 to 7,910 and 8,111 to 8,160.

Anglo-American Telegraph Co., Ltd.—The resolutions passed at the meeting held on September 29th are to be submitted to an extraordinary general meeting on Monday, October 16th, for confirmation as special resolutions.

Oriental Telephone & Electric Co., Ltd.—The directors have declared the following interim dividends:—3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax and 3 per cent. on the ordinary shares, free of income-tax. The warrants will be posted on 31st inst. The share transfer books will be closed from 12th to 25th inst.

Parsons Marine Steam Turbine Co.—The directors' report for the year ended June 30th, recommends a dividend at the rate of 10 per cent. per annum, tax free, of which an interim dividend of 5 per cent. for the six months to December 31st has been paid, and also a bonus of 2½ per cent., tax free, carrying forward £17,509.

Indo-European Telegraph Co., Ltd.—The directors have declared an interim dividend for the half-year ending June 30th last at the rate of 5 per cent. per annum, free of income-tax, payable on and after November 1st. The transfer books will be closed from 18th to 31st inst.

Canada.—The Barcelona Traction, Light and Power Co., capitalised at $40,000,000, divided into 400,000 shares of $100 each, has received a Dominion charter giving it power to develop and sell electrical energy. The head office is at Toronto.

The Mexican (Midland) Light and Power Co., with a capital of $15,000,000, has received an Ontario charter giving the company power to carry on the business, outside Canada, of electric light, heat and power supply. These two big institutions will deal in foreign enterprises largely.

MARKET QUOTATIONS.

Wednesday, October 11th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a ,, ,, ...	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£10 10	..
a Copper Sulphate	,,	£20	..
a Lead, Nitrate	,,	£24	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¼d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70 %) ..	,,	£11	..
a ,, Chlorate	per lb.	3¾d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b ,, Wire, in ton lots ..	,,	£102	..
b ,, Sheet, in ton lots ..	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c ,, Tube (brazed)	,,	9d.	..
c ,, ,, (solid drawn) ..	,,	7½d.	..
c ,, Wire, basis	,,	6½d.	½d. dec.
c Copper Tubes (brazed)	,,	9¾d.	..
c ,, ,, (solid drawn) ..	,,	8¾d.	..
g ,, Bars (best selected) ..	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electrolytic) Bars ..	,,	£67 10	..
e ,, ,, Sheets ..	,,	£73 10	..
e ,, ,, Rods ..	,,	£60 10	..
e ,, ,, H.C. Wire	per lb.	7⅝d.	..
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	5/- to 7/-	..
h India-rubber, Para fine	,,	4/5½	4d. dec.
j Iron Pig (Cleveland warrants)	per ton	46/1½	7½d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£15 10	5s. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 10	2/6 dec.
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large ..	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	165/-	..
c Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£192 to £198	£10 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/1	..
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£33	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
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p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

THE course of the Stock Exchange markets is still sufficiently chequered to cause proprietors a certain amount of uneasiness in regard to their holdings in securities which are at all speculative. Although the political disturbances are supposed to be in the way of progress towards settlement, and though the singular Italian-Turkish war is declared to be no menace to the peace of Europe at large, anxiety and restlessness are prevalent in other directions. There can be no doubt that the fall of the past three months has caused grave inconvenience to capitalists large and small, and every other day brings its cloud of rumours telling of financial difficulties in various important quarters.

British Railway stocks are at the mercy of every seller who comes along, and the market is very backboneless. With the off-chance of a miners' strike, combined with the uncertainties respecting the findings of the Railway Commission, there is little disposition on the part of investors to open out fresh purchases. Moreover, traffics are none too good, and in spite of the strike decreases becoming gradually wiped out, there is not sufficient brightness in the situation to encourage speculation on the bull tack.

The Brighton Company's stock has been more particularly attacked during the past few days, having fallen to 93. This price, it should be noticed, includes the full dividend in respect of the current year, which will become payable next January, and which is not likely to be less than 5 per cent., to be on the safe side. Even this prospect, however, does little to steady the market. Undergrounds have weakened with the steam stocks, Metropolitans and Districts both showing small losses. Districts were bid for at one time on the renewed attention directed to the stock on account of the publicity afforded to the opening of the moving platform, at Earl's Court, between the District Company and the Piccadilly Railway. The price, however, on balance shows ¼ fall, and the 6 per cent. Debenture stock fell a point to 145. The Central London and City and South London groups show no change, although the market in them—and more especially in the former—is a very tender one. Central London New 4½ per cent. Preference stock, for which it may be recalled there was a tremendous rush at the time it was offered, is quiet at 85 for the scrip, £7 5 paid, and there is a fair amount of business being done in it.

The feature in the Home Traction department is the big rise in British Electric Traction shares of both kinds. That these advances should occur so shortly before a meeting at which the directors' scheme will be severely criticised is somewhat remarkable, and rather suggests that one party or the other is endeavouring to get hold of a line of shares, possibly for voting purposes. Other Home Traction issues are mostly unchanged. Metropolitan Electric Tramways Ordinary, however, eased off $\frac{1}{32}$, although the company's 4½ per cent. Debenture put on a point, and London United Tramways Debenture went back to the same extent. South Metropolitan Preference at 15s. are a good feature.

English Electricity Supply shares continue to droop, and falls are recorded in Bournemouth Second Preference, Charing Cross Preference, and Westminster Ordinary. The Preference shares of the last-named company are a trifle higher at 5⅛. The company's extension of its works is proceeding apace, and it is thought that completion will be reached somewhere about next June or July. The company is doing most of the work itself, and is, of course, spending a lot of money on the extension. Newcastle-on-Tyne shares at 4½ are ⅛ higher, being the only issue in this section to show any improvement on the week. Amongst the prior-charge stocks Urban Debenture at 87½ is a point higher.

In the Telegraph market the principal feature has been a fresh outbreak of excitement in Marconi shares. On one day they were whirled up from 44s. to 47s. 6d. bid, reverting later to 46s. 6d. Most of the buying continues to come from Dublin. The Anglo-American trio is unchanged, with the exception of ⅛ loss on the Deferred, reducing the price to 24⅜. Great Northerns are a little easier, and Globe Telegraph Ordinary drooped to 10¾, thus losing most of the improvement registered last week. West India and Panama shares are $\frac{1}{16}$ higher.

The Stock Exchange learned with much regret of the death of Mr. William Seal, one of the oldest dealers in telegraph and telephone shares. Mr. Seal had been a member of the House for 35 years, his membership dating back to 1876. It was partly due to his efforts, and to those of his firm, that this market, as a channel for investment, was kept prominently before the House.

National Telephone Deferred remains very firm, and there is a good deal of business going on in the stock at between 119 and 120, though, with the public so shy of operating, speculation is checked by the general uncertainties prevailing elsewhere. New York Telephone Bonds are ¼ down to 103¼.

Mexican Light and Power Common, Preference and Bonds have improved on the ready way in which the new President has been accepted, Monterey bonds rising a point for the same reason, and although reports are afloat as to some revolutionary raids in one of the provinces, the Stock Exchange treats this latter lightly. Mexico Tramway bonds of both classes are higher, although the company's Common shares are a point down. Rio Trams rose ⅜ to 117¾. This company's 5 per cent. bonds appear to be the best secured in the Latin-Canadian division. They have a huge amount of ordinary capital and mortgage bonds behind them, on which dividends and interest are regularly met, and from the point of view of safety, the company's first mortgage bonds are probably, as we have just observed, the best in this section.

Madras Ordinary shares rose ¼, and there is more disposition to buy Indian shares in view of the probable stimulus to business that will be given to all the big Indian cities in connection with the Durbar celebrations. Calcutta Trams rose ½, but the Lighting shares are unaltered. British Columbia Deferred is up 1½, the Preferred Ordinary rose 1, and the 5 per cent. Preference ½, there being a steady demand for the company's stocks. Sao Paulo is also a very good market, with a rise of 4½ points. The shares have, of course, reached a price at which movements are almost necessarily large, because it takes so little buying or selling to affect the quotation substantially. Shawinigan Water Capital rose 2. West Kootenay Gold Bonds are again ½ up, and Montreal Light, Heat and Power gained 3. Northern Light and Power bonds are flat at 35.

Amongst manufacturing shares, the principal alteration is a rise of 5s. in General Electric Preference, which are being quietly bought in consequence of the success that is attending the sale of the company's metal-filament lamps. Willans & Robinson's Preference fell a similar amount, some of the holders trying to realise on account of the lamentable report upon which we commented last week. Castner-Kellner regained their slip-back, and the Debenture stock is 1 higher. The Electrical Exhibition at Olympia has had practically no effect upon the market, although the members who have attended it agree that the show is not only interesting, but very educational.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 10th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	7⅞ — 8⅜	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅛	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	7⅝ — 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅛ — 7⅜	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 —102	..	3 18 5
Charing Cross, West End & City	5	5	5	3⅝ — 4⅛	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	— 1/16	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	3⅝ — 4⅛	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	99 —100	..	4 10 0
City of London, Ord.	10	7	7	12 — 12½	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	11⅜ — 12⅜	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 8
County of London, Ord.	10	5	5	7⅜ — 7¾	..	6 7 0
Do. 6 % Pref.	10	6	6	10½ — 11½	..	5 6 8
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100½ —103½	..	4 7 0
Edmundson's, Ord.	5	Nil	Nil	3/16 — 5/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	5½	6	4½ — 5 xd	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛ xd	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	8¾	9	6¾ — 7⅜	..	6 2 0
Kensington & Knightsbridge, Ord	5	8	9	6⅞ — 7⅛	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅞ — 4⅞	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3¾ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3¾ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4¼	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16 2
Notting Hill	10	7½	8	.. ..	..	..
Oxford	5	7	7½	6 — 6½	..	5 11 8
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	3¾ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98 xd	..	4 11 10
Urban, Ord.	5	5	5	¾ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½ xd	+1	5 1 8
Westminster, Ord.	5	10	10	7⅝ — 7⅞	— ⅛	6 7 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	+ ⅛	4 8 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 6 8
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	106 —109 xd	+1½	6 8 5
Do. 7 % Pref.	$100	7	7	118 —122 xd	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	2	3	⅜ — ½	..	3 8 4
Do. 5 % Deb.	100	5	5	92 — 95 xd	..	5 5 3
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86 — 88	+ ½	5 13 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	14/16 — 15/16	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101½ —103½	..	4 16 7
Madras, Ord.	5	Nil	..	2⅜ — 3⅜	+ ½	.. ..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88½	..	5 13 0
Mexican Lt. & Power, Common	$100	4	4	86 — 88	+ ½	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	108 —110	+ ½	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 96	+ ½	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	+1	5 8 8
Montreal, Lt., H. and Power	$100	6	7	170 —175	+3	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	84 — 86	—2	18 17 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 5
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101 xd	..	4 9 1
Shawinigan Water, Capital	$100	4	4	117 —119	+2	3 7 3
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1/16 — 1	..	.. ..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	106 —108	+ ½	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅛ — 7⅜	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8	136 —138 xd	—1	5 15 11
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3⅜	3⅜	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111⅜ —112⅜	..	5 6 8
Do. Def.	Do.	25/-	30/-	24½ — 25	— ⅛	6 0 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	7	6⅛ — 7⅜	..	4 18 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86½ — 88½ xd	..	4 10 5
Cuba Telegraph	10	6	6	10⅛ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17⅛ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3¾ — 4 xd	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅛ — 8¾ xd	..	5 14 3
Do. 4½ % Debs.	£50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	4½	7⅞ — 8⅛	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
Do. 8½ % Pref. Stock	Do.	8½	8½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102½ —104½	..	3 16 7
Eastern Extension	10	7	7	13⅛ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5⅝	5⅝	10⅜ — 11 xd	— ⅛	5 6 10
Do. 6 % Pref.	10	6	6	12⅝ — 12⅞	..	4 9 9
Great Northern Telegraph	10	18	18	30½ — 31½	— ½	5 18 5
Indo-European Telegraph	£5	13	13	56¼ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	83 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	74 — 76	..	5 5 3
Marconi's Wireless Telegraph	1	Nil	Nil	2⅜ — 2⅝	+ 1/16	..
Monte Video Telephone, Ord.	1	5	6	⅛ — 1	..	6 0 0
Do. 6 % Pref.	1	5	5	3/16 — 5/16	..	6 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	118 —121	..	4 19 2
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅜	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅝ — 10⅛	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	96 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102⅜ —103⅜	— ½	4 6 9
Oriental Telep. and Elec.	1	8	8	1⅞ — 1 11/16	..	4 14 10
Do. 6 % Cum. Pref.	1	6	6	1 9/16 — 1 11/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	£5	5	5	9 — 9½ xd	..	4 4 3
Submarine Cables Trust	Cert.	6	6	133 —136	..	4 8 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7 7/16	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2⅛ — 2⅜	— 1/16	2 11 1
Do. 6 % Cum. 1st Pref.	10	6	6	10⅛ — 10½	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9⅞ — 10⅛	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅛ — 13⅜	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 ..
Western Union Tel., 4% Bnds. A	$1000	4	4	107 —110	..	3 12 ..
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 10th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	½ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	6⅛ — ⅜	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	77 — 81 xd	..	5 11 1
Brit. Elec. Trac., Ord.	10	Nil	Nil	1⅛ — 1⅜	+ 1/16	Nil
Do. 6 % Pref.	10	3	1½	8⅜ — 4½	+ ⅛	3 10 7
Do. 5 % Deb.	100	5	5	90 — 93 xd	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	48 — 50	..	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1¾	28¼ — 29½	..	5 1 8
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1908	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅞ — 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	⅝ — ¾ xd	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79 xd	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2⅝ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	8 — 9⅛	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	—1	5 6 8

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 10th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1	1⅛	41 — 41½	— ⅛	3 6 3
Do. Surplus Lands	100	2½	2½	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	88 — 90	—1	3 17 9
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	24½ — 24¾	— ⅛	Nil
Do. 6 % Deb.	100	6	6	144 —146	—1	4 2 2
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	Nil	3½	85 — 87	..	3 14 9
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13 4
Metropolitan Elec. Trams, Ord.	1	5	5¼	1 — 1	..	5 10 0
Do. Def.	1	Nil	Nil	⅝ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	1 — 1	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	100—102	+1	4 8 3
Do. 5 % Deb.	100	5	5	100—102 xd	..	4 18 0
Potteries, Ord.	1	2	2	⅞ — 1	..	
Do. 5 % Pref.	1	5	5	⅞ — 1	..	7 12 4
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	⅝ — ¾	+ ⅛	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1⅛ — 1⅜	..	
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	Nil	1	57 — 59	..	1 13 11
Do. Power House Debs.	100	..	4	100 —102 xd	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2¼ — 2½	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	6 — 6½	..	4 15 3
Do. 2nd Pref.	5	5	5	4⅛ — 4⅜	— 1/16	5 1 3
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10½ — 11½	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	+ ½	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6⅜ — 7	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 18 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	+1½	5 10 4
Do. Pref. Ord.	100	6	6	191 —195	+1	4 16 0
Do. 5 % Pref.	100	5	5	108 —111	+ ½	4 10 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½	..	4 5 4
Calcutta Trams, Ord.	5	4½	6	5⅞ — 6⅛	+ ⅛	4 14 1
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	⅞ — 1	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅛	..	4 12 6
Do. 4 % Deb.	100	5	5	96 — 99	+1	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100½—103½	+ ½	4 16 7
Kalgoorlie Elec. Trams	1	Nil	Nil	⅜ — ⅝	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	62 — 66	—1	7 11 6

La Plata Elec. Trms, Prf.	1	6	6	⅝ — 1 3/32 xd	..	5 16 4
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7	117 —119	—1	5 17 8
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	+1	5 0 0
Do. 6 % Bonds	100	6	6	98 —100	+1	6 0 0
Para Elec. Rlys. & Lt., Ord.	5	..	10	6⅞ — 7⅛	..	7 0 4
Do. 6 % Pref.	5	6	6	8¼ — 8½	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	2½	1⅛ — 1⅜	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5¾ — 5⅞	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	1	4½	117½—118½	+ ⅜	3 16 1
Do. 1st Mort. 5 % Bonds	..	5	5	101½—102½	..	4 17 10
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½ xd	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10	177½—180½	+ 4½	5 10 10
Do. 5 % 1st Deb.	$500	5	5	103½—105½	+1	4 14 9
Singapore Trams, 5 % Deb.	100	5	5	82 — 85 xd	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	5	6	5½ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105½—107½	..	4 3 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	⅜ — ½	..	Nil
Do. 6 % Pref.	1	12	9	11⅝ — 12⅜	..	7 7 8
Babcock & Wilcox	1	24	26	5⅜ — 5½ xd	..	4 10 5
Do. Pref.	1	6	6	1⅛ — 1⅜ xd	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞ — 7⅛	..	6 17 11
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	4	4	58 — 61	+1	6 11 2
Do. 6 % Prior Lien	100	6	6	99 —101 xd	..	5 18 10
Browett, Lindley, Ord.	1	Nil	Nil	1/6 — 2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- — 6/-	..	Nil
Brush, Ord.	2	Nil	Nil	⅛ — ¼	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛ — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9⅜	..	7 18 10
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Casiner-Kellner	1	14	17½	8½ — 8⅝	+ ⅛	4 16 7
Do. Deb.	100	4½	4½	104 —106	+1	4 3 4
Crompton & Co.	3	Nil	Nil	⅜ — ½	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10

Dick, Kerr	1	6	5	13 — 15	..	5 6 8
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. fully paid	5	Nil	Nil	1⅜ — 2½	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	77 — 80 xd	..	6 5 0
Electric Construction	2	Nil	Nil	1 — 2	..	6 13 4
Do. Pref.	2	7	7	1½ — 1¾	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8⅜ — 9½	+ ½	5 8 1
Do. Deb.	100	4	4	86 — 91 xd	..	4 7 11
Henley's, Ord.	5	15	15	12 — 12⅜	..	5 17 8
Do. Pref.	5	4½	4½	4⅛ — 5⅜	..	4 5 11
Do. Deb.	100	4½	4½	106½—108½	..	4 2 11
India-Rubber, G. & T.	10	10	10	13½ — 15½	..	6 9 0
Do. Pref.	10	5	5	9½ — 10⅜	..	4 16 5
Telegraph Construction	12	17½	20	34½ — 36½	..	6 11 7
Do. Deb.	100	4	4	109 —103	..	3 18 5
Willans & Robinson	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. Pref.	5	1½	Nil	¼ — ⅜	— ⅛	Nil
Do. Deb.	100	4	4	55 — 65	..	6 8 1

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 4 per cent., September 21st, 1911.

ELECTRICAL ACCIDENTS IN MINES.

The year 1910 will be remembered in the annals of the mining industry as one in which the number of accidents was the highest on record; for the greatest single colliery disaster that ever occurred in Great Britain, namely, that at Hulton Colliery, which caused a loss of 344 lives; and also for the introduction of the Eight Hours Act which caused strikes in the North of England, and general dissatisfaction of both owners and workmen, owing to decreased earnings and increased costs.

As regards accidents, it is with regret that we notice from the reports of the H.M. Inspectors of Mines that no fewer than 20 persons were killed and 48 injured by the use of electricity in mines. This, at first sight, appears to be serious—and, in fact, is serious—but these casualties really form a very small proportion of the total number of accidents, the majority of which are due to "falls" of side and roof. This latter type of accident will probably never be completely eliminated, and there is every reason to think that the Eight Hours Act by causing the workmen to hurry over their work has largely contributed towards the increase; but with regard to the electrical accidents, the sad part of it is that most of them might easily have been prevented had the plant been properly installed and supervised.

Year after year the Inspectors report upon the trumpery way in which electrical plant is installed, and the careless manner in which it is worked and supervised, yet little improvement appears to take place, in spite of "special rules" for the installation and maintenance of electrical plant. We have reason to think, however, that mining engineers are now beginning to recognise that electricity cannot be done without, and that it pays to install high-class machinery, and to carefully attend to it after it is installed.

In No. 1 District (Scotland) five persons were killed by shock, whilst 12 were injured underground and two persons were injured on the surface. The first fatal accident caused the death of a motor attendant. "He was seen to have hold of one of the cables in the roadway close to his motor; and though a man close by offered to pull him off, he would not allow him to do so, but sent him away to have the current switched off. This man, however, was ignorant of how to switch off, nor was there anyone in the vicinity, except the deceased, with better knowledge. Another miner, hearing of the accident, got some india-rubber gloves, and went to the scene, but by that time the man was insensible. He was removed from contact and artificial respiration was tried for two hours, but without restoring consciousness." On examination it was found the cables contained a joint, and that one of the joints was insulated, or rather covered, as it could not be *insulated* by *waterproof tape only*, and the unfortunate man had caught hold of this faulty joint, and received the fatal shock in consequence. The system in use was three-phase at 500 volts, and the supply was obtained from a neighbouring colliery. The neutral point of the generator was earthed, and the deceased, therefore, would get a shock between one phase and earth—about 290 volts. Legal proceedings were taken against the manager for failing to see that Special Rule 11 was carried out, which provides that a "competent person shall be on duty at the mine"; but, after a long hearing, the Sheriff "found the charge not proven." Such is the law!

The second accident caused the death of a putter boy, who was seated close to a switch controlling the running of a coal conveyor at the time of the accident. The system of supply was three-phase at 500 volts, the neutral point being insulated, and the current was led to a triple-pole oil switch mounted on a wooden stand and fixed some 10 to 20 yards from the coal face. Between the switch and conveyor was a coil of cable which was payed out as the conveyor motor was moved forward with the advance of the coal face. From evidence given at the inquiry, it appeared that the conveyor had been stopped for some repairs, and during this period the boy had nothing to do. He seated himself by the switch, and when the attendant went to switch on the current after an interval of about a quarter of an hour, he was found to be dead, and there was no doubt that his death was due to electric shock. A piece of wire about 12 in. long was found hooked on to the side of the switch-box, and this wire had evidently, from its appearance (small globules of metal) carried current and been fused at some time or other. On top of the switch were several rows of terminals protected by a metal cover, but *between this cover* and the *switch top* on each side was a clear space of about $\frac{1}{2}$ in. × 6 in. One of these terminals showed signs of arcing, as to a small piece of wire such as that found. This evidence, coupled with the fact that the switch was tested and examined and found to be in order, suggests that the boy had been amusing himself by thrusting the wire, which was found hooked to the side of the switch, underneath the cover through the clear space until he touched a live part, and thus was responsible for his own death. After the accident, the terminals were properly covered, as they ought to have been before they were allowed to go down the pit. Not to have them so was clearly a breach of the "Special Rules," and the manager ought to have been prosecuted for the omission. No one, of course, would ever expect that a boy would poke about with a piece of wire amongst the live terminals, and one might have thought that a cover to prevent anything from falling directly on to the terminals would be sufficient. It is, however, the unexpected that always happens, and it is the unexpected actions of pit boys that must be guarded against.

The third accident resulted in the death of a roadsman, who was actually engaged on the main haulage way in repairing the damage caused by a runaway hutch at the time of the accident. This main haulage way is level for about $\frac{1}{4}$ mile from the shaft bottom, but from that point it dips 1 in 7. The roof is supported by side props, with steel girder crowns. The runaway hutch was carrying timber in-bye and was in charge of two men. They seemed, however, to have spragged it poorly, with the result that it got out of control at the top of the dip. In running down the incline it displaced some props, bringing one of the steel girders down on to the cable. The flange of the girder *cut through the insulation* of the cable to the copper core, and deceased, in attempting to lift the girder in order to clear the roadway, received a fatal shock. The girder in the position in which it fell was not touching earth; it fell with one end on the cable, and the other on a wooden sleeper, so that it was practically insulated.

Current at this colliery is obtained from a power company as three-phase current at 400 volts. The neutral point of the system is connected to earth, and, therefore, deceased would receive a 230-volt shock.

"The damaged cable was an unarmoured bitumen insulated cable. There can be no doubt whatever that the conditions are precisely those in which mechanical protection is required for cables; a roof supported by girders and a fairly steep incline, with the constantly present possibility of a hutch or set of hutches getting out of control. Both the electricians at the pit and one of the owners agreed that the use of armoured cable is desirable in such cases."

Whilst an armoured cable *might* in this case have prevented the accident, we must not forget that several armoured cables have been *cut through*, and *might* have also been cut through in this case. A safer and cheaper plan is to put the cables unarmoured in *strong* wooden boxes, which it is practically impossible to break.

In the fourth the deceased was in charge of the running of a face-conveyor, and he was actually about to switch off current from the conveyor motor at the time of the accident.

"Current at this colliery is generated as three-phase current at 440 volts. It is used at this pressure chiefly for pumping and for driving coal conveyors. Armoured cables are used. At the gate-end switch, controlling the conveyor motor south of the shaft in the coking coal seam, there was at the time of the accident a short length of armoured cable connecting up a 400-volt-100-volt transformer, current at the lower pressure being used for lighting. The deceased was heard to groan when in the act of switching off the gate-end switch, and he was then seen to have his left hand on the lighting transformer. An effort was made to pull him off, but it was not for some few minutes afterwards that he was freed by the switching off of the current at a switch in series with the gate-end switch some 20 or 30 yards away.

"Examination of the lighting transformer showed that

the cable inside the case had become bared, and there is no doubt that contact between this bared part and the transformer case was the primary cause of the accident. In the ordinary way the transformer case would be connected to earth through the armouring of the incoming cables, but this connection (through a brass gland) *must have been a very poor one at the best*, and it had failed. It is probable that deceased placed his hand on the transformer cable in approaching the gate-end switch, and that in doing so he made contact between the bared cable and the transformer case and caused the armouring, which had been very poorly secured, to slip out of the brass leading-in gland. In this way the transformer case would be made 'live.' Deceased was standing on a wet iron plate at the time of the accident, and it is probably due to this fact that the 240-volt shock he received proved fatal. The neutral point of the generator was connected to earth.

"This case indicates the uncertainty of depending upon a gland for an earth connection. It is better not to depend only upon a gland, but to connect in addition a short length of cable to the armouring of the incoming cable and to the body of the transformer by properly designed lug connections. No stress can possibly in these circumstances be taken by the earth connections, and this is as it should be. The earth circuit is frequently regarded as of no great importance, certainly of less importance than the main circuit. It is not, however, of *less* but of *greater importance*, for if the latter fails, it merely means the shutting down of the machine, whereas if the former fails it may result in a fatal accident. The transformer gland was *evidently not designed for the purpose for which it was used*, namely, as an earth connection to the cable armouring. It was probably intended merely as an oil-tight gland for the cable."

The italics are ours, and are sufficient to indicate that there was probably no one on the colliery who *understood* what an *earth* was, let alone how to couple it up properly.

Out of 12 non-fatal accidents, Mr. Walker describes four, the first of which caused a conveyor attendant's hand to be burned by a motor fuse which he had just replaced when he was switching on the current with the fuse exposed. "He should have had the cover of the fuse-box closed before switching on the current. To prevent an accident of this kind it is desirable to make the use of boxes compulsory with which the switch cannot be opened or closed unless the box is closed."

In the second a "coal-cutting machineman received a shock owing to the frame of the coal-cutter becoming live, although it was supposed to be earthed through an old cable and haulage rope to a plate sunk at the surface. On examination of the switch and connecting boxes, it was found that the vulcanised bitumen sheet below No. 2 phase block was charred at a point where the connection passes into the switch-box. This probably accounted for the discharge of electricity to the frame of the machine, but why with the frame earthed the man received a shock is not quite clear. It is possible the wires of the old haulage rope may have been broken inside it, and thus been of no use for the purpose for which it was used. Old haulage ropes are unsatisfactory on account of their liability to breakage, and should not be used for making earth connections. The earth connection is even more important than that for the supply current, as it is a question of fatal injury if the former is not in order, whereas with the latter it is only work that is interfered with.

"In this case a galvanometer test was applied between the current-carrying parts and the frame of the machine, to locate the fault on the machine, without success. This is not surprising, as such a test is of no value. For such tests an ohmmeter, giving not less than the working voltage, and preferably rather more, should always be used for this purpose. To do as was done in this case, as Mr. Nelson very aptly said in his remarks on this accident, is 'exactly like applying a test of 2-lb. pressure to a 200-lb. pressure boiler to find a small weep of leak.' This practice is common in Scotland, and I would, therefore, draw the attention of managers to the uselessness of it.

"The use of a galvanometer to test the continuity of the earth connections is right and proper, for if the test is satisfactory with a pressure of 4 volts, there is no doubt of a current at 500 volts pressure being dispersed. To quote Mr. Nelson again, in order to bring home to all concerned that the application of a pressure of, say, 500 volts for this purpose is useless and misleading, he says, 'applying 500 volts to test continuity is rather like testing an eggshell for a breaking stress with a 500-lb. weight.' If the continuity of a conductor is broken a high voltage may jump across, and a low voltage is required to indicate such a defect."

In the third an "engineman's fingers on right hand were burned when he was taking out the switch in connection with the leakage indicator. Owing to the switch being one of single-break type, and also to the fact that he was slowly taking out the switch, arcing took place between the earth terminal and the main terminal. After the accident the switch was replaced by a larger and simultaneous-break switch of the double-break type."

The fourth resulted in the "driver of a coal cutter receiving a shock from a 500-volt D.C. supply, and his hand was burned. The machine was being started for the first time; shortly after it began the electric current failed, the man made an inspection to discover what was wrong, and found there had been fusing at a junction box. In order to ensure that all was dead, he sent one of the men assisting him to the main switch to switch off, but he appears to have gone to the switch of another section by mistake, and when the driver was working at the box he was burned, and received a slight shock. In fixing the cable in the junction box *the ends did not meet*. The electrician *joined them by a piece of fuse wire*, and it was this wire that fused. The driver was attempting to fix this wire when the accident occurred. The electrician was very much to blame for doing as he did, and the driver should have gone himself and switched off. Such reprehensible conduct as the former was guilty of, is the cause of accidents, and it is fortunate that the driver did not receive a fatal shock."

The italics are ours, and these may be taken as typical of the minor electrical accidents in mines; as a rule, they can all be traced to bad plant or workmanship. Fancy a man—anywhere else except at a colliery—joining up a cable with a bit of fuse wire. No wonder there are agitations against the use of electricity by the workmen, when this sort of thing is allowed to go on. Why was this man not prosecuted?

Mr. Walker also reports that no fewer than five persons were killed by being caught by the cutter bar of the bar coal-cutting machines when operating them at the coal face. It is very satisfactory to note, however, that the makers have devised a gear which will prevent the bar revolving when it is not under-cutting, and, further, have promised not to send out a machine in future without this gear.

There were two fatal accidents in No. 2 District (Newcastle), but, unfortunately, no particulars are given. One occurred at the surface, and was "due to the curiosity of a young man in charge of a motor, who opened the switchbox without authority." The box, of course, should have been made so that he could not open it. No one could very well take off the top cover of a steam valve to see what was inside it, and colliery switches should be built on the same lines. The other was underground, and due to a "connection having been accidentally made on the surface between a lighting system carrying current at 250 volts and telephone wires extending into the mine." It would be interesting to know how this happened.

There was only one fatal underground accident in No. 3 (Durham) District, and as this is peculiar, we extract Mr. Nicholson's full report.

"It occurred at Auckland Park Colliery, and resulted in the death of an engineman who was braking a hauler driven by a three-phase motor of 110 H.P., which received its current at 2,400 volts through an armoured three-core cable. The controller stood upon a wood floor, and was not in metallic contact with the motor casing. The motor was only in contact with the hauling gear through the wheel gearing. The framework of the switchboard, the controller casing, and the frame of the motor were earthed by a copper wire attached to a copper rod embedded in damp coke breeze. When at his place of work, the engineman stood upon a dry wood floor, and hence, if not in contact with any metal portion of the machinery, was fairly well insulated. At his left hand he had the controller handle, on his right the haulage gear

clutch lever, and at his feet a pair of foot-step brake levers. The electrician had only left the engineman some two minutes previously, and was standing ten yards distant when he heard him shout 'Oh!' as the set was landing. He at once ran towards him, and found him lying dead on the floor. The controller handle was found, on examination, to be in the 'off' position. Repeated and careful tests failed to disclose any fault with the plant.

"An inquest was held by Mr. Coroner Proud on February 12th. The medical evidence, obtained partly from a *post-mortem* examination and partly by eliminating other possible causes of death, favoured the idea that death was brought about by electric shock, but this was by no means considered to be conclusive, and Messrs. Bolckow, Vaughan & Co.'s chief electrical engineer, in his evidence, stated that on examination he had found no leakage or defect, and considered it absolutely impossible that the deceased could have received a shock.

"The jury returned the following verdict: 'Shock from electric current whilst following his employment, but there was no evidence to show how he came in contact with the electric current.'

"After the inquest, feeling that the occurrence had not been satisfactorily explained, Mr. Nelson, H.M. Electrical Inspector, on the invitation of Mr. Bain, made further investigation, and also conducted some resistance tests of the various paths to earth, with interesting results. If there was a leakage at the controller at the time the engineman had hold of the handle and had his foot on the brake, there would be two paths to earth; one by the earth wire to the earth rod, and the other through the man's body and then through the brake strap to the hauler. It has been explained that the incoming cable was armoured. With this sound earth Mr. Nelson showed that the haulage gear brake-lever footstep was in *better connection with earth* than the metal rod, to which the motor frame and the controller casing were connected. Hence it is possible, given a leakage at the right moment, that the man did get a shock. The leakage, if any, must have been the result of *momentary arcing* to the controller casing, but it must be said that *no evidence of this was found*. Since the accident the motor frame, controller case and switchboard frame have been connected by stranded wire of ample section to the armouring of the cable."

The italics are ours, and we believe Dr. Thornton has conclusively proved that arcing may take place in a closed controller or switch box, *without showing any sign* of having done so, and hence this shows the necessity of careful and substantial design to ensure that arcing cannot possibly occur. It also shows the danger attached to high-pressure current, and the necessity of getting a good earth connection to the surface. It is of no use to get a good connection to earth in the pit, if there are one or two coal seams between it and the surface, which have such a high resistance that current cannot pass.

There was also a surface fatal accident which was "due to forgetfulness on the part of the deceased, who had been employed as a fitter on the works for some months. One of his duties each morning during the breakfast hour, when the machinery was standing, was to clean out and oil the (cake oven) stamping machine. This was operated by a three-phase motor, the current at 500 volts being obtained from three bare wires by rubbing contacts. Before going to the machine it was his duty, which he had regularly performed, to switch off the current. On this particular morning he was found by the stamping machine attendant lying on his machine. On going to the switch the attendant found it was on, and after pulling it off, the deceased was removed from the machine and artificial respiration tried for 1½ hours, but when a doctor arrived he pronounced life extinct. The switch was quite in order, and it can only be surmised that on that particular occasion the deceased had omitted to put the switch off, an act of forgetfulness which cost him his life."

There must, however, have been something else wrong, as if the machinery was standing, the starting switch should have been arranged to cut off the current entirely from the machine.

(To be continued.)

ELECTRICITY AND THE LAY PRESS.

By H. E. GOODY.

The relations which subsist between the electrical industry and the lay Press are curiously interesting, and the man who makes only a casual study of them is well repaid by the insight which he thereby gains into the petty purposes and trifling intrigues of daily journalism.

On the journalistic side, these relations seem to be tinged with a sort of vindictive ignorance, which has done incalculable harm in the way of prejudicing electricity in the public mind. Ignorance in regard to technical detail is, of course, expected of the newspapers; but there is no excuse for their habitual inaccuracy in electrical matters of general interest.

The general public are, of course, not in a position to check the statements of the Press in this connection; and even if the average man were sufficiently versed in electrotechnics to perceive journalistic errors and evasions, he would probably keep his knowledge well under control, and subdue himself to that human and mysterious instinct which impels to a child-like trust in the printed word.

It is useless for the electrical profession to attempt to keep its own end up by means of articles in the electrical papers. The general public do not read trade papers; and, in any case, the letterpress of a technical journal is not sacrosanct. It is permitted for one to disbelieve it on the ground that it is obviously biased.

If anything effective in the way of neutralising the results of newspaper inaccuracies is to be done, it must be done in the newspapers themselves. You cannot successfully combat a definite newspaper untruth with a mild protest in an electrical paper. If the *Daily Wail* unjustly lays the blame of some awful disaster on the innocent electrical installation, then the *Daily Wail* must be made to withdraw its damaging statement, or, at any rate, an article contradicting the false report should be inserted in its columns.

So far, any reference to "gas" has been rather cleverly avoided; but no doubt the intelligent reader will have seen the drift of the writer's remarks. All those sly attacks on electricity, and those skilfully-worded innuendoes which are constantly appearing in the Press, are simply one phase of the losing battle which the gas interests are waging against the electrical industry.

It would be very instructive to get at the real explanation of the recent and widespread habit of blaming electricity for all the fires which occur on premises with an electric light or power supply. This is always done, except in cases where the true cause (usually totally unconnected with electricity) is so extremely obvious that it can neither be overlooked nor suppressed. The daily paper is the worst—indeed, apart from the gas journals, the only offender, and the ordinary untechnical man who falsely accuses electricity is simply making ignorant repetition of something he has seen in his morning paper.

But if the "man in the street" is innocent of everything but ignorance, the same cannot be said for the journalists who so constantly pen the false phrase: "It is supposed that the fire was due to the fusing of an electric wire." One likely explanation of this singularly unscrupulous journalism is that the reporters who "write up" fires are influenced by the gas interests.

All the available evidence gives good ground for the surmise. And, of course, it does not necessarily mean that reporters are given direct cash payments for their services in this connection. It may be that these inaccurate paragraphs, damaging to electricity, and therefore, by implication, helpful to gas, are simply the newspapers' method of gratefully and delicately recognising the generosity of the gas companies in the distribution of advertising contracts.

There is no need to give examples of the way in which newspapers father the most unlikely fires on electricity. To members of the electrical profession, this habit has been for some time a source of irritation, and the fact that these

untrue reports have not invariably received immediate contradiction in the journals which originated them is due, not to any doubt of the reality of the grievance, but mainly to a certain diffidence and dislike to controversy, which seem inherent in those who work with such a spiritual medium as electricity.

In rare cases, of course, the newspaper man is right in tracing a disaster to electricity; but as he always guesses the same way, it is obvious that he must sometimes guess right.

It would not be so bad if electricity were a likely cause of fire; there would then be some excuse for jumping to the conclusion that nearly all the fires on premises lighted by electricity were due to that illuminant. But no sane man who studies the characteristics of electricity, and who removes himself from the baneful influence of the papers, can dispute the proposition that, of all lighting and heating agents, electricity is certainly the least dangerous. Gas lighting, with its naked flame, high temperature, and extreme susceptibility to explosion, escapes newspaper censure altogether, and probably for the reason given.

We are fighting the gas interests, fighting them to the bitter end; but, thank heaven, we fight on the square. The gas companies have imported crooked and misleading methods into what promised to be a straight, sporting contest; and when the end comes they will suffer, not only defeat, which was inevitable from the first, but also humiliation, which might have been very easily avoided.

It is well known that coal-gas will asphyxiate anyone who breathes it to any considerable extent; it is not so well known that a financial interest in the exploitation of coal-gas induces asphyxiation of the moral sense. And yet it is a very justifiable inference from the conduct of the big gas corporations.

Sometimes the journalist, in his misguided efforts to prove the deceptively dangerous nature of electricity, arrives at conclusions which are both wrong and funny.

A halfpenny morning paper, some five or six years ago, reported a case in which a horse had been killed by stepping on a road grating charged with electricity. Up to this point there had been strict adherence to fact; but when it went on to remark that "it would require a great deal of electricity to cause the death of a robust carthorse, and it is supposed that the electric fluid, which emanated from a leaky circuit in the neighbourhood, must have been accumulating in the grating for many years, until at last there was a sufficient charge to bring about this regrettable accident" one simply had to drop the paper and laugh heartily at the egregious idiot who could put his pen to such rubbish.

Well, the end is approaching, and gas has very nearly had its day—or, should one say, its night? As a proof, one may point out that the gas companies, in spite of their extensive and almost hysterical advertising, direct and indirect, in the Press and in their own pamphlets, are rapidly losing ground to the electricity supply companies, who practically do no advertising at all. It is a clear case of winning entirely on merit.

Gas has long since given up the pretence of being fashionable (it is essentially a mid-Victorian product); it now claims to be safe, and to make its claim of any significance it must prove that electricity is dangerous. The contrast between the old aloofness and indifference to public opinion, and the modern and almost fawning attitude of the gas companies would be laughable if it were not so pathetic.

One seems to have heard somewhere that the electrical interests had formed a sort of joint publicity committee, whose duties consisted in advertising, in a general way, and without reference to any specific firm, the many advantages of electricity. If this committee has done any work, it has very carefully concealed the fact.

Perhaps one might suggest that this modest and retiring committee should leave ordinary advertising to individual firms, and give its whole time and attention to hunting up, tracing to their several origins, and effectively contradicting, the frequent inaccurate references to electricity in the daily Press.

A vigorously conducted campaign of this sort would do a tremendous lot of good to the industry; and it is to be presumed that that is what the committee is out for.

THE MUNICIPAL TRAMWAYS CONFERENCE.

Tramcar Meters.

(*Abstract of Paper by* R. G. Cunliffe and J. G. Cunliffe, *Manchester Corporation Tramways.*)

The result of a long series of investigations into the relationship between energy consumption and maintenance costs, carried out during the past few years at Manchester, has been to demonstrate clearly that in the case of certain wearing parts of the equipments, in which the energy losses increase with wear, the economical life is determined by the energy loss rather than by the extent of the wear.

Thus the scheme of maintenance is largely settled by the energy losses, the methods employed at Manchester having been briefly referred to in the authors' paper presented at the Nottingham Conference of the Association in September, 1908.

At that time the methods were still of too recent application to permit of results being given; but, in the three years which have since elapsed, savings have been made which have proved their efficacy and vindicated the somewhat increased maintenance costs.

Curves A and B, fig. 1, show that the rate of energy consumption commenced to fall from the time that the methods were applied in 1908, the saving increasing as the equipments were gradually brought to a state of increased efficiency.

The whole of the large increase in rate of energy consumption prior to 1907 was not due to the increasing inefficiency of the equipments, as the proportion of large bogie cars in use was steadily increasing whilst the covering of cars was proceeding at a rapid rate; but curve B shows that the units per ton-mile also increased to a considerable extent, and the effect of increasing weight ought to have been to slightly diminish this, since weight added to a car does not proportionately increase its rate of energy consumption, so that there was no doubt as to the importance of the increasing losses.

From curve C it is evident also that the mileage run was increasing rapidly, and the transmission losses, being roughly proportional to the square of the mileage, were becoming of relatively greater importance.

The actual saving effected is shown approximately by the shaded area in curve A, and would have been greater but for the fact that the proportion of bogie cars has continued to increase, as also has the covering of existing cars, so that the average weight per car is much in excess of the 1907 value, as is shown by curve D.

It is difficult to obtain an exact knowledge of either the value of the saving effected or the cost of obtaining it, but, although the first cost of renewing faulty field coils, worn gearing, &c., and adopting a heavier gauge of trolley wire where necessary, was comparatively heavy, it has already been balanced by the saving in energy, which, in addition, is cumulative over a number of years, during which the increase in maintenance charges will be very slight. The lost mileage due to defective equipments has fallen considerably from 1908 to 1910, and is still rapidly decreasing, thus indicating the state of increased efficiency of the equipments.

On the whole, therefore, by keeping down the losses it is possible to maintain the equipments in a better condition, with increased public safety and comfort, and, at the same time, to effect a saving, but this necessitates as exact a knowledge as possible of the values of the various losses, and one of the principal functions of the meters ought to be to supply this information. This, however, can only be done by meters capable of giving absolute values.

Another of the most important functions of the meters is to afford a means of measuring the comparative care and skill exercised by the motormen in the handling of their controllers. This can only be done, in the case of meters giving relative readings, on the assumption that every meter, working under similar general conditions, has the same percentage error; an assumption of the accuracy of which no proof has as yet been offered.

In the present paper the authors have endeavoured to show, as fully as the limited space allows, the importance of absolute values and the possibilities of obtaining them, the scope and accuracy of the application of relative values, the behaviour of the meters under working conditions, and the factors controlling their use and effectiveness as a means of reducing the consumption of energy.

The watt-hour meter survived its early failure, and, by continued improvement, has been able, in many cases, to hold its own against its rivals, of which the only important ones are the ampere-hour meter and the time-meter.

Electrical energy is a product of three components, viz.:—voltage, current and time, all of which, in traction work, are subject to simultaneous and rapid fluctuation over a wide range.

The three types of meter are contrasted in Table I:—

TABLE I.—Conditions Governing the Use of Meters as Energy Meters.

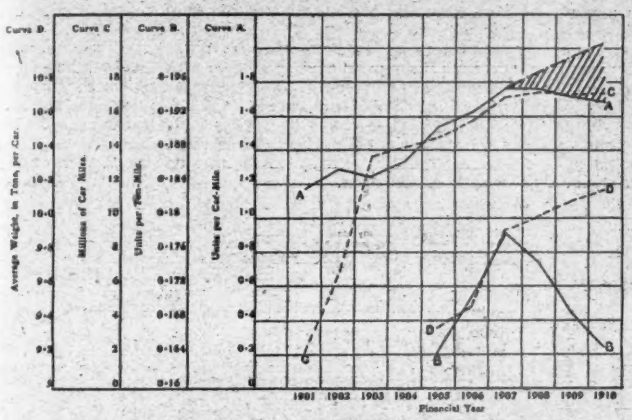
Type of meter	Energy components actually measured.	Components assumed to maintain a constant average value.	Remarks.
Watt-hour meter	All	Nil.	Theoretically complete
Ampere-hour meter	Current and time	Voltage	Partially complete
Time-meter ...	Time	Voltage and current	Incomplete

As an auxiliary meter the authors have developed a volt-hour meter, the readings of which, when divided by the time, give the average value of the fluctuating voltage along a route, and, in addition, have used graphical recording instruments and measuring instruments of many kinds for checking purposes.

If meters are to be expected to give absolute readings it is essential that they shall be capable of accurate operation under the actual working conditions, and, since it is useless to indulge in speculation as to the probability or otherwise of the truth of

Vibration reduces the friction, causing the meter to run slightly fast, but this is balanced by a slight retardation due to inertia effects.

Both ampere-hour and watt-hour meters have the great advantage that they are not called upon to operate with currents lower than 30 per cent. of the normal full load for which they are designed, thus avoiding the inaccuracies frequently encountered in these meters at light loads, and enabling full advantage to be taken of the flat part of the calibration curve



Curves: A, Units per car mile; B, Units per ton mile; C, Car mileage D, Average weight of car.

FIG. 1.—ENERGY STATISTICS; MANCHESTER TRAMWAYS.

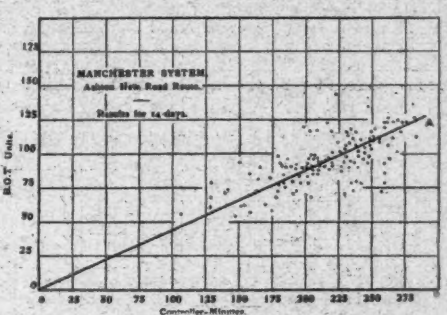


FIG. 2.—RELATION BETWEEN ENERGY AND TIME METER; POINTS REPRESENT RESULTS OBTAINED DAILY BY EACH DRIVER.

the assumptions made in Table I, great pains have been taken in checking the accuracy of the meters by actual measurement. This accuracy has been examined from the following standpoints, viz. :—

1. As a means of measuring the energy component or components which each meter is specially designed to measure.
2. As true energy meters having regard to the simultaneous and rapid fluctuation of the three components.
3. As true energy meters when assisted by an auxiliary meter.

The authors have employed several forms of time-meter, and have found the most successful to consist of a clock having a small electric motor of peculiar design in place of the mainspring, governing being obtained by means of a hair-spring and balance wheel, the motor providing the motive power and driving the clock when the current flows.

Experiments conducted with a contact maker rotating at a known constant speed, and completing the circuit for a predetermined part of each revolution, have shown the accuracy of the

Ampere-hour meters of both the mercury and commutator types, by various makers, have been tested and found to be capable of accurate operation within limits of 2½ per cent. over the whole of the working range, whilst, if accurate when installed, they have been found to be still accurate within 1 per cent. when tested after six months' continuous operation.

As the volt-hour meter is merely an ampere-hour meter designed for a very low current, and with a suitable series resistance in place of the shunt, its accuracy is that of the ampere-hour meter working at the most favourable parts of the load range.

Experiment shows that the average voltage on a route, as determined by the volt-hour meter, is practically independent of the car on which the volt-hour meter is installed, so that a single volt-hour meter will give the true average voltage for a route. Evidently, then :—

1. Every ampere-hour meter on the same route fails to register energy by the same definite percentage, and hence ampere-hour meters may be employed without correction for the purpose of

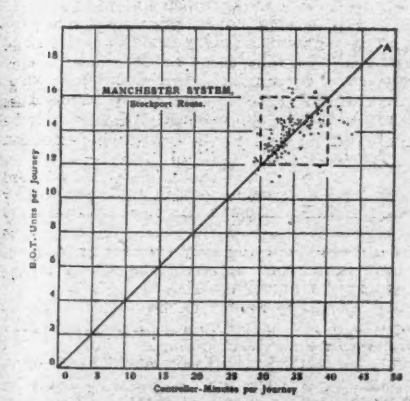


FIG. 3.—TYPICAL EXAMPLE OF SIMULTANEOUS RESULTS WITH ENERGY AND TIME METERS.

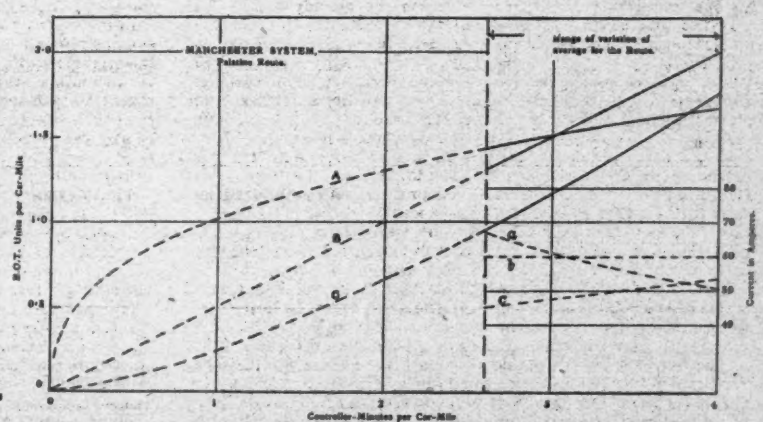


FIG. 4.—TYPICAL RELATIONSHIPS BETWEEN UNITS AND CONTROLLER-MINS. PER CAR MILE.

meter, at frequencies of operation corresponding to the quick handling of a controller, to be that inherent to clockwork generally, which, so far as meters are concerned, represents practical perfection.

Lord Kelvin* checked his most delicate current-measuring instruments by means of the copper voltameter, and the authors have made use of the same method in order to check the actual error of the ampere-hour meter when in operation on the car.

It is described in an appendix, and affords a means of measuring the ampere-hours to an accuracy of within half of 1 per cent.

Meters whose percentage error had been carefully determined in the test room were operated in series with the cell on service cars, and their error was found to be almost exactly as predetermined, showing that there was no appreciable error due to vibration and to the rapid fluctuation of the current.

This is of great importance and proves the test-room calibration to be reliable.

placing drivers or cars in their correct order of merit as regards consumption of energy, although such readings could not be accurately used to determine the percentage difference between the values of the various men or cars.

2. The readings of the ampere-hour meters, when corrected for the true average voltage, give the actual energy consumption. This correction need only be applied to average daily, weekly, or monthly values for either each separate car or for the whole route, as desired, in order to estimate the value of the line losses by comparison with the station meters, or to compare the consumptions of cars on different routes.

There is no direct method of checking the accuracy under service conditions of the watt-hour meter, but numerous readings have been taken of watt-hour meters operating in series with ampere-hour meters, checked by volt-hour meters, both of known accuracy, and it has been found that watt-hour meters do not work very accurately on a line with wide voltage variation.

In Manchester, owing to high-tension transmission to a network of over 20 sub-stations, each having a number of short, heavy, low-tension feeders, radiating in all directions, the voltage regulation

* "Electrolysis of Silver and Copper," *Phil. Mag.*, October, 1886.

is within 10 per cent., especially as every section is fed from the centre, and unusually heavy trolley wires are used and paralleled for mutual assistance.

The difference between the uncorrected ampere-hour meter readings and the watt-hour meter readings was found to be, within the limits of permissible error of the instruments, that due to the difference between the average line pressure and the 500 volts for which the ampere-hour meters are calibrated.

The Peel Green and Whitefield (Salford) route, of practically 22 miles per complete journey, was divided into several sections, according to the feeding system, and readings were taken over each section for four days, with the result that the watt-hour meter appeared to read high at the lower voltages, the error, as compared with the corrected ampere-hour meter, exceeding 10 per cent. on a 35 per cent. voltage variation.

In order to check this error under more favourable conditions, the instrument was taken to the Polygon Testing Department of the Manchester Electricity Works, where it was found the range of error may exceed 6 per cent. on a wide voltage variation, and, under

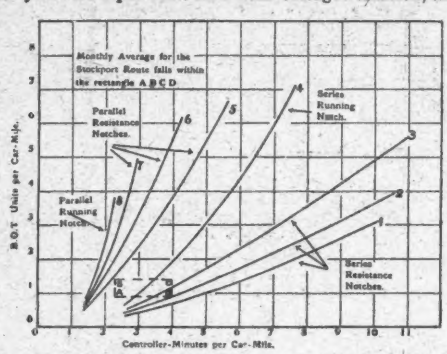

Monthly Averages for the Stockport Route falls within the rectangle A B C D
Parallel Resistance Notches.
Series Running Notch.
Parallel Running Notch.
Series Resistance Notches.
B.O.T. Units per Car-Mile.
Controller-Minutes per Car-Mile.

Fig. 5.—Relationship between Units and Controller-Mins. per Car-Mile for a Car equipped with 2-G.E. 52-27 h.p. Motors.

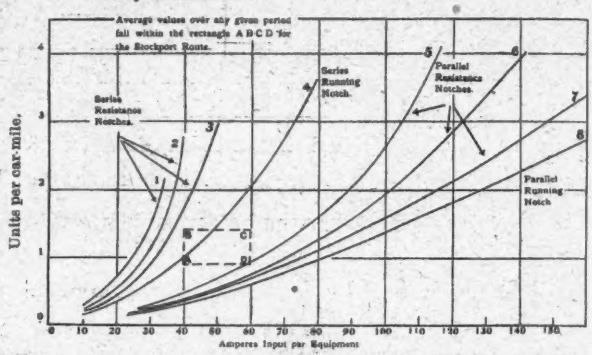

Average values over any given period fall within the rectangle A B C D for the Stockport Route.
Series Running Notch.
Parallel Resistance Notches.
Series Resistance Notches.
Parallel Running Notch
Units per car-mile.
Amperes Input per Equipment

Fig. 6.—Relationship between Units per Car-Mile and Amperes Input per Equipment, derived from Motor Characteristics, and applied to a Route where Schedule Time is equally divided between Controller, Coasting and Stopping.

utility, as it is found that two drivers, working under these conditions, can obtain very different results, although, when averaged over a month, the only variable is the method of driving.

Analysis of thousands of records shows the process of improvement to be extremely involved, new difficulties arising at all points in its study, but, although the complex conditions necessitate complex methods of investigation, the authors have endeavoured to explain the occurrences in as simple a way as possible (all mathematics required for the analysis of the results has, with this object, been placed in an appendix, and the data derived from its use alone given in the text).

It has been shown that there is no simple relationship between energy consumption and controller time, and various drivers can obtain the same value of units per car-mile with very different controller minutes per car-mile.

This is explained by the curves A, B and C in fig. 4, which illustrate various relationships between the two quantities. These are curves actually given by three men on the Palatine route with exactly similar cars.

the more severe practical conditions, the fluctuations of current and voltage being simultaneous and rapid, this range was exceeded.

Evidently, if these results are typical of the watt-hour meter, it fails under the very conditions which would render its use desirable; and, whilst the above represent difficult conditions, they are, nevertheless, to be encountered on numerous tramways in this and other countries.

In the opinion of the authors, it is better that one such widely-fluctuating component, alone, should be measured by each meter, when there will be no mutual interference, and the whole attention of the designer can be concentrated on the already sufficiently-involved conditions.

If the time meter is to be of any use as a means of obtaining absolute values—*i.e.*, as an energy meter—there must be a direct proportionality between its readings and the energy consumption, whilst, if it is even to be used as a means of comparison between drivers or cars, there must still be some definite relationship, although it need not necessarily be a direct one.

In order to investigate this relationship, whole routes have been equipped with both energy meters and time meters, and the analysis of thousands of daily averages has proved that, for reasons discussed later, the time-meter cannot be made to give absolute values, and, further, that it cannot even be employed with fairness to the men, as a means of comparison between them, although the general tendency of a reduction in controller time is to cause a saving or energy.

Figs. 2 and 3 show typical cases taken from practice, and the whole of the points shown ought, if the meter is to be in itself of any value, to lie on, or reasonably close to, a straight line, such as O A or some other line, straight, or of continuous curvature.

The fact that they do not do so proves that there is no simple relationship between energy consumption and controller time, whilst this is further shown by a table giving the order of merit of a series of drivers, as determined respectively by energy and time meters.

The general tendency of a reduction in controller time to cause a reduction in the energy consumption is evident from the table, but, as is shown later, the energy saving is very indefinite, and actual harm may be caused if the process is carried too far.

Car meters are generally supposed to effect a saving in energy by promoting careful and skilful handling of the controller. They tend to prevent waste of energy by running with the brakes on, running on the resistance notches, approaching stopping places too rapidly, with consequent loss in braking, &c.

This increased care is what is really meant by the "moral effect" of meters, and in itself may result in fairly considerable economies, but skilful driving is a very different matter, and no amount of coercion, whether by meters or otherwise, can make a man drive skilfully if he does not know how to do so.

Numerous experiments have been carried out in Manchester with a view to determining the effect of various methods of driving, and, although the knowledge gained is by no means complete, many interesting results have been obtained. Whole routes have been equipped with both an energy and a time meter on each car, and separate daily records have been kept for every man and car. Further, in order to facilitate the investigation, Mr. McElroy arranged some time ago for each of the 20 cars on the Palatine route to be operated by the same two men working alternate weeks on early and late finish duty. This precaution has been of great

The working range is from 2·6 to 4 controller minutes per mile, as indicated, and it is evident that with the same value of the energy consumption these three men would have very different time meter readings. Thus, for example, at 1·6 units per car-mile, which is about the average monthly value for this route, the controller minutes per car-mile would be 3·2, 3·5 and 3·74 respectively.

This variety of possible curves is the real reason why the time meter does not classify either men or cars in the correct order of their energy consumption. There is a different curve for every man according to his method of driving, and the general tendency of the low time meter readings to indicate low rates of energy consumption, already referred to, is shown by the falling curves.

In the majority of cases it is found that a man keeps to a certain general method of driving, giving points lying fairly close to a smooth curve which can be drawn and analysed. This is invariably the case when the man covers a wide range of controller time per mile, the extreme upper and lower values lying on the curve whilst the points situated near the average value are clustered around the curve. It is men who maintain approximately the same value of controller time, from day to day, whose results do not give any curve, and they are few in number.

Fig. 5 shows the theoretical relationship for each controller notch, and every man must work up and down all these curves and from one to another, remaining on particular curves for different proportions of the time according to his method of driving; and when it is considered that each of the daily averages, from which the actual curves in fig. 4 are built up, is compounded of a great number of such instantaneous values covering the whole range of fig. 5, the complexity referred to is obvious, especially as each of these daily averages may fall anywhere within the rectangle of A, B, C, D, which represents their working range.

The shapes of the curves in fig. 4 afford an indication of the general methods of driving by which they have been obtained.

Figs. 6 and 7 show the great economy of parallel, as compared with series operation, and, again, every driver must traverse each of these curves and move about from one to another in obtaining his daily average result. The relatively heavy losses on the resistance notches are obvious, and, together with the increased torque per ampere obtained, as shown in fig. 8, at higher currents, indicate the desirability of getting on to the running notches as quickly as possible consistent with the comfort of the passengers, which latter consideration may be trusted to restrain the drivers, owing to fear of complaints, from too quick starting.

The economy af parallel running is shown in Table II, which gives the average results of a series of observations taken on the Palatine route.

The route was divided into three sections corresponding to city, urban and suburban traffic, this being rendered possible by other routes branching off at two places such that each section was of nearly equal length, the minimum being over two miles.

Skilled observers, stationed at each sectional boundary, took the readings of time-meter, energy-meter, and time as each car arrived, and all meters were fitted with tenths dials in order to permit of the accurate reading of small quantities.

Hundreds of journeys were checked on different days in different months and the average values determined.

It is evident that series operation entails a comparatively long use of the controller, a comparatively low average time-rate of

energy consumption as shown by the units per controller-minute, and a high distance-rate of consumption as shown by the units per car-mile.

TABLE II.

Section.	Units per car-mile.	Controller minutes per car-mile.	Units per controller minute.	Average speed (miles per hour).	Remarks.
All Saints' to town, return	2·26	5·28	0·429	5·39	Heavy city route. All series running, very frequent stops.
All Saints' to Birch Villa and back	1·99	3·35	0·592	8·52	Urban route. Frequent stops. Mainly mixed series and parallel running.
Birch Villa to terminus and back	1·395	2·99	0·467	10·9	Suburban route. Good opportunity for parallel running.

Parallel running, on the other hand, necessitates a greatly reduced use of the controller, a slightly greater time-rate, and a much smaller distance-rate of consumption, and it is in this distance-rate, the units per car-mile, that economies are to be effected.

Returning to the curves in fig. 4, it would appear that the use of the controller is mainly series in curve A, mixed in curve B, and parallel in curve C.

The characteristic upward tendency is shown in curve C, which is evidently a much purer curve than the other two, where there is a greater proportion of mixed driving.

If the installation of meters becomes general, the station engineer is threatened with a reduction of revenue in much the same way, though not to the same extent, as that caused by the advent of the metallic-filament lamp, with the added disadvantage that the increased economy will not bring him an increase in the number of his connections in the shape of cars, since the schedule adopted is fixed by other than energy considerations.

It is of interest to consider the probable effect of this saving on the maximum demand, as there appears to be every probability of traction energy charges in the future being based upon a maximum-demand rate.

The current taken by a car is proportional to the average energy demand of the car in units per controller-minute.

It is evident that, as the controller-time diminishes, *i.e.*, as improvement continues, the average demand increases for a driver working along curve A (fig. 4) remains constant for curve B, and diminishes for curve C.

In the case of curve A, however, it will be observed that the proportionate increase of average demand, as measured by current, is small compared with the reduction in the time during which the demand continues, and hence, owing to the lesser probability of many cars simultaneously requiring a supply of energy, the station maximum demand would be reduced even if every driver worked along the curve A.

As a matter of fact, however, it is observed that any marked improvement in driving is effected, not by working lower down a given curve, whether A, B or C, but by falling bodily on to a lower curve and consuming less energy at very similar values of the controller-time, and this, if it became general, would proportionately reduce the maximum demand.

The ideal method of driving, as regards energy consumption, would be to get fairly quickly into parallel, remaining there at full speed until approaching a stopping place, then to switch off at such a distance that the car would just come to rest without application of the brakes; but this long coasting would be wasteful of time and is prevented by the fixed schedule time, which is important in so far that it hinders the men in obtaining the best results and should be taken into consideration in comparing the records of men on different routes.

Table II shows the predominating influence of "Type of Route," the values given in the city part being much higher than for pure series running on account of the great number of stops, and the authors are of opinion that it is not possible to effect much saving on such routes, as there is practically only one way in which a man can drive, his whole attention being taken up in getting his car along at all.

Low line pressure, due to bad feeding arrangements, compels the driver to remain longer on the controller in order to maintain a given schedule, but the average demand is reduced in practically the same proportion, so that the effect is to alter the relationship between energy consumption and controller time without materially increasing the former.

It is very difficult, therefore, to make a fair comparison between drivers or cars on different routes; and in a city like Manchester, where large numbers of part-day cars are run at the rush hours, separate comparisons must be made even between cars on the same routes.

One result of the installation of car meters is to call attention to the great importance of brake setting, and, however careful the supervision, cases of tight brakes are very common, causing great waste of energy. This difficulty is being met by the use of brake gear fitted with a conical drum, giving a large initial movement of slack chain and brake blocks with a leverage gradually increasing to a maximum when the block is on the wheel. This permits of an increased clearance between the blocks and the tires.

In order to facilitate correct reading of the meters by unskilled men, the dials ought invariably to be of the cyclometer type with spring figures, and a tenths dial ought to be provided, the figures being painted red, whilst the other dials bear figures in black.

Clock face dials invariably lead to confusion, and in the case of cyclometer dials without spring figures, it is possible to have two figures, each half exposed, when a driver is being relieved, with the result that each driver takes the figure most favourable to himself, and, as this generally occurs at the units dial, one unit is lost. If a tenths dial is provided, an error of reading in the last figure will be unimportant, whilst the other figures can always be corrected by a comparison of meter cards.

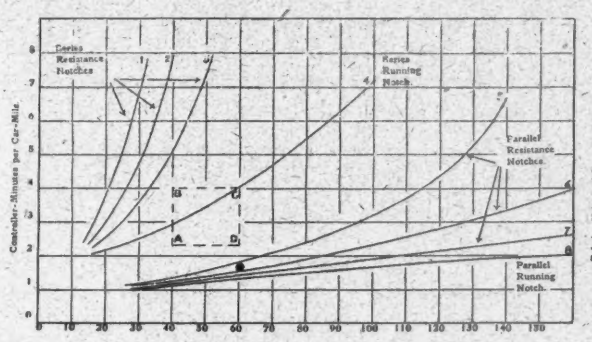


Fig. 7.—Relationship between Controller-Mins. per Car-Mile and Amperes Input, for the Case given in Fig. 6.

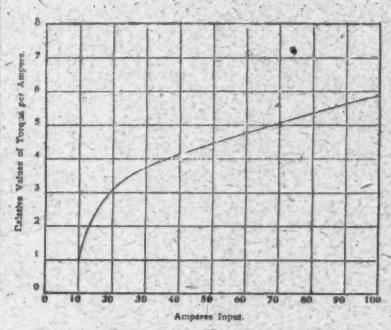


Fig. 8.—Relative Values of Torque per Ampere, for Series Traction Motors.

An analysis of the schedule recently compiled by Mr. Goodyer shows that, on 19 systems which have furnished complete replies, the average saving by the use of meters amounts to £22·66 per meter per annum.

The authors have had an opportunity of verifying the saving effected at Bury; a reduction of 21·79 per cent. was made in the energy consumption corresponding to a saving of £41·6 per meter per annum.

It is quite out of the question to expect such results on large city tramways, owing to the limitations which have already been described, and to others which indirectly complicate matters; but, although comparatively little can be done in the driving, there is no reason why the full saving resulting from efficient equipments should not be realised, and so, in the case of such undertakings, the absolute values become proportionately of greater importance.

The use of meters has already been widely discussed, and the methods adopted must depend largely upon local conditions, so that no useful purpose can be served by a detailed description of the Manchester methods.

As a general principle, however, the methods ought to be designed to exert a continual pressure on the men, as otherwise their improvement will not only gradually cease, but they will actually slip back into the old values.

It has been found profitable in Manchester to fix a limiting value, slightly better than that obtained by the best driver for each route, and to encourage the men to aim at reaching that value.

The authors are satisfied that:—

1. The ampere-hour meter can, with proper supervision, be made to operate with an accuracy of within 1 per cent.

2. If percentage differences between the results of various men are required the corrected values must be used.

3. The watt-hour meter, owing to its greater complexity, more fragile construction, &c., is not so desirable an instrument as is the corrected ampere-hour meter.

4. The time meter cannot be trusted to measure energy within 10 per cent., and should only be employed in conjunction with the

energy meter for purposes of investigation, in which connection it is very valuable.

5. The volt-hour meter ought to be employed on all tramway undertakings for the purpose of measuring average voltages.

6. On small undertakings with light traffic approximately equal savings may be effected in the driving and in the detection of faulty equipments, but, as the congestion increases, the state of the equipments becomes of increasing importance, more especially as regards the feeding and distributing system where the losses are a fraction of the total energy consumption, and do not merely affect the consumption of individual cars.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,149. "Automatic sectioning means for limiting accidental interruptions of current supply in central stations." E. Brandenburg. (Convention date, October 10th, 1910, Belgium.) September 25th. (Complete.)

21,164. "Circuits for automatic or semi-automatic telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) September 25th. (Complete.)

21,165. "Cord weights of telephone switchboards or the like." Siemens Bros. & Co., Ltd., and E. A. Laidlaw. September 25th. (Complete.)

21,168. "Electrical plug switches." J. Y. W. Macalister. September 25th.

21,178. "Receiving instruments for electrical signalling systems." E. I. Everett. September 25th.

21,196. "Method of mounting electric resistance nets and coils." H. H. Broughton. September 26th.

21,215. "Automatic regulation of variable-speed dynamo." E. P. Prior and A. G. Prior. September 26th.

21,259. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparatus Fabrick E. Zwietusch & Co., G.m.b.H., Germany.) September 26th.

21,260. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparatus Fabrick E. Zwietusch & Co., G.m.b.H., Germany.) September 26th.

21,286. "Electric walking sticks." M. H. Goldstone. September 27th.

21,290. "Electric heating apparatus." R. K. Hearn. September 27th.

21,313. "Combination for jointing or coupling together incandescent electric lampholder parts." J. Moon. September 27th.

21,321. "Means of and methods for changing the frequency of alternating currents." A. M. Taylor. September 27th.

21,322. "Power and electrical installation of power-propelled vehicles." F. W. Lanchester. September 27th.

21,334. "Manufacture of insulated electric leads or cables." F. H. Broomfield and E. H. Tawn. September 27th.

21,351. "Hand combination telephonic instruments." E. A. Graham. September 27th. (Complete.)

21,402. "Selective electric signalling systems." C. M. Jacobs and G. H. Crook. September 28th.

21,403. "Devices for applying electric, galvanic, magnetic, or the like energy to the human body." E. B. Johnson. September 28th.

21,419. "Plug and socket or other connections for electric circuits." J. Lucas and F. Jenkins. September 28th.

21,441. "Electrical ignition apparatus for internal combustion engines." A. H. Midgley and C. A. Vandervell. September 28th.

21,456. "Fire alarm telegraph systems." A. C. Brown. September 29th.

21,462. "Radioactive accumulator." C. Abel-Musgrave. September 29th.

21,475. "Magneto." A. C. Saunders. September 29th.

21,489. "Dynamo-electric machines." Hon. Sir C. A. Parsons and A. H. Law. September 29th.

21,495. "Electric switches." H. Lucas and O. Lucas. September 29th.

21,496. "Dynamo-electric machines." Hon. Sir C. A. Parsons and A. H. Law. September 29th. (Complete.)

21,501. "Electric-current circuit-breakers more particularly for use in connection with tramway and railway systems." P. M. Levy and H. T. George. September 29th.

21,542. "Lightning and high-tension protector for use in connection with telephone, telegraph, electric lighting and power conductors and apparatus." R. McLean. September 30th.

21,599. "Production of copper by electrolysis." R. Douvreleur. September 30th.

21,597. "Electrically-heated flat-irons." T. McClelland, Jun. September 30th.

21,600. "Apparatus for the purification of electrolytic gases." A. E. Knowles. (Divided Application on 27,264, November 23rd, 1910). September 30th.

21,613. "Dynamo-electric machines." J. D. Walford. September 30th.

21,616. "Sparking plug for internal-combustion engines." H. E. Mills. September 30th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Apparatus for the Transmission of Electrical Impulses for Telegraphy, Typesetting and the like. H. Knudsen. 13,917. June 8th.

Electric Switch adapted to come into Operation when Currents have Reached their Predetermined Value. R. Venner and R. C. Griesbach. 14,471. June 15th. (December 15th, 1910.)

Signalling Systems. British Thomson-Houston Co. (General Electric Co.) 16,868. August 10th.

Electromagnetic Devices for Controlling Electric Switches or the like. British Thomson-Houston Co. and Wedmore. 20,872. September 7th.

Methods of and Means for Discharging Electric Accumulators or Secondary Batteries. A. M. Taylor. 20,906. September 8th.

Means for Mounting Conductors on Electric Railways. J. H. Mawson. 20,917. September 8th.

Rotary Transformers for Converting Alternating into Direct Current. L. R. Aubert and A. E. F. Ferrand. 20,948. September 8th.

Electricity Meters According to the Ferraris Principle. M. Strelow. 21,240. September 12th. (September 10th, 1909.)

Wireless Telegraphy and Apparatus therefor. J. Sacek. 21,311. September 13th.

Detachable Heater for Electric Cooking Utensils and such like. J. C. C. Macdonogh. 21,557. September 16th.

Apparatus for Sterilising Liquids by Ultra-Violet Rays. A. H. Helbronner and M. von Recklinghausen. 23,078. October 5th.

X-Ray Frames. R. P. J. Willis. (Granger.) 23,658. October 12th.

Variable Electric Air Condensers. B. F. Sobotka. 24,916. October 27th.

Enumeration of Telephone Calls. S. D Williams. 25,700. November 5th.

Electric Switches. M. J. Railing and C. C. Garrard. 26,009. November 9th.

Polyphase Electric Commutator Motors. J. Gray. (Latour.) 26,119. November 9th.

Secondary Batteries. C. Inrig and Gavan Inrig, Ltd. 28,755. December 16th.

Electric Illuminating Signs. W. W. Arnold. 29,452. December 19th.

Joints for Telegraph, Telephone, Electric Transmission Poles and the like. H. J. Johnson. 30,047. December 28th.

Supports for Electric Incandescent Lamp Filaments. British Thomson-Houston Co. (General Electric Co.) 30,323. December 30th.

1911.

Thermal Switch Mechanism for Electrically Heated Appliances, particularly for Kettles. G. H. Collins and H. F. Collins. 1,900. January 25th.

Electric Heaters or Convectors. J. E. Pownall. 6,374. March 14th.

Processes of Preparing Filaments for Electric Incandescent Lamps. W. G. Housekeeper. 17,480. August 1st. (August 5th, 1910.)

Supports for Electric Incandescent Lamp Filaments. A. S. Knight. 17,482. August 4th. (August 6th, 1910.)

Manufacture of Electric Incandescent Lamps. H. G. Moller. 1,162. (June 17th, 1910.) January 16th.

Electric Regulating Arrangements. W. E. Lake. (United States Light and Heating Co.) 9,363. April 15th.

Device for Welding the Metal Filaments of Electric Incandescent Lamps. E. Majert and W. Gladitz. 12,104. May 19th.

Electric Condensers. Aktieselskabet Hovlands Radiotelegraf. 12,976. May 30th. (June 1st, 1910.)

Safety Device for Controls for Electric Motors. J. Woodford. 15,469. July 3rd.

Revenue Charges on the German Electrical Industry.—The Hansa Bund has just published tables respecting the public legal charges imposed upon the German electrical industry since 1900. The following are the results recorded:—

	Paid-up share capital.	Percentage dividends.	Charges in per cent. of the dividends paid.
1900 ...	£3,219,500	3·764	13·5
1901 ...	5,994,500	5·996	22·8
1902 ...	6,044,500	5·062	29·0
1903 ...	6,044,500	6·164	26·8
1904 ...	6,044,500	8·319	18·47
1905 ...	7,215,750	12·604	14·40
1906 ...	7,215,750	13·953	16·30
1907 ...	7,215,750	13·948	19·08
1908 ...	7,692,500	13·353	25·40
1909 ...	7,742,500	13·093	30·41

It will be seen that the public burdens imposed on the companies have risen from 13·5 per cent. of the dividends paid in 1900 to 30·41 per cent. in 1909. In addition, the companies made voluntary contributions to benevolent funds amounting to 2·2 per cent. of the dividends paid in 1900, 8·3 per cent. in 1901, 8 per cent. in 1902, 6 per cent. in 1903, 7 per cent. in 1904, 7·2 per cent. in 1905, 6·7 per cent. in 1906, 7·8 per cent. in 1907, 10·2 per cent. in 1908, and 8·9 per cent. in 1909. The tabular statement, naturally, does not take into consideration the additional financial burdens which were placed upon the electrical industry by the Imperial scheme of financial reform which was adopted late in 1909. The percentage dividends on the paid-up capital appear to be higher than the actual results during the past few years, and must be accepted with a certain amount of reserve.

Fixation of Nitrogen in Norway and Austria.—The German newspapers announce that an important alteration is impending in the organisation of the Norwegian nitrate undertakings which were constituted in equal shares by the Badische Anilin und Sodafabrik, of Ludwigshaven, and the Norsk Hydro-Elektrisk Kvaelstof Aktieselskab, of Christiania. Both groups are in course of reaching an agreement whereby the majority of the shares in the joint Norwegian undertakings shall pass into the possession of the Norsk Co., and the management would then be concentrated in the latter. The German group will remain interested to the extent of £250,000 in the nitrogen works, the capital of which will now be substantially French. The large works near Rjukanfoss are being extended.

A syndicate, which is headed by Giovanni Zentini, of Riva, projects the erection of a nitrogen of lime works in the Val di Daone, South Tyrol, by the utilisation of the water power of the Chiese. The power to be used amounts to 24,000 H.P., and the expenditure on the works is estimated at £250,000. No objections to the scheme were raised at the recent official inquiry into the matter. The consumption of nitrogen of lime in Austria-Hungary, which has hitherto been obtained almost exclusively from the Norwegian works of the Badische Anilin und Sodafabrik at Notodden-Svalgfess, reaches about 15,000 tons per annum.